PROJECTS ■ THEORY ■ APPLICATIONS ■ CIRCUITS ■ TECHNOLOGY

NUTS AND VOLTS

NUTS AND VOLTS
www.nutsvolts.com
September 2014

EVERYTHING FOR ELECTRONICS

HALLOWEEN SPECTACULAR

THE MAKING OF THE
Rock Golem

PEEK-A-BOO GHOST

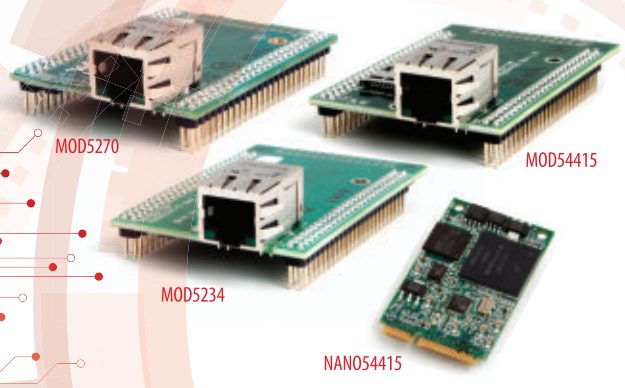
MONSTER IN A BOX

BUILD RUBY'S FLAME

HAUNTING WITH THE PICAXE

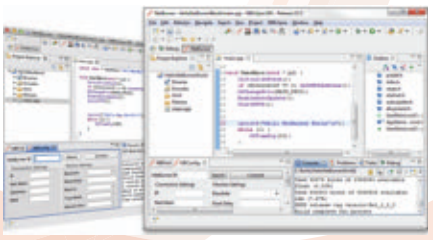
PUMPKINFX
SCARE FOR A CURE
CNC TOMBSTONES

Ethernet Core Modules with
High-Performance Connectivity Options



- **MOD5270**
  147.5 MHz processor with 512KB Flash & 8MB RAM · 47 GPIO
  3 UARTs · I²C · SPI
- **MOD5234**
  147.5 MHz processor with 2MB flash & 8MB RAM · 49 GPIO · 3 UARTs
  I²C · SPI · CAN · eTPU (for I/O handling, serial communications, motor/timing/engine control applications)
- **MOD54415**
  250 MHz processor with 32MB flash & 64MB RAM · 42 GPIO · 8 UARTs
  5 I²C · 3 SPI · 2 CAN · SSI · 8 ADC · 2 DAC · 8 PWM · 1-Wire® interface
- **NANO54415**
  250 MHz processor with 8MB flash & 64MB RAM · 30 GPIO · 8 UARTs
  4 I²C · 3 SPI · 2 CAN · SSI · 6 ADC · 2 DAC · 8 PWM · 1-Wire® interface

Add Ethernet connectivity to an existing product, or use it as your product's core processor



The goal: Control, configure, or monitor a device using Ethernet

The method: Create and deploy applications from your Mac or Windows PC. Get hands-on familiarity with the NetBurner platform by studying, building, and modifying source code examples.

The result: Access device from the Internet or a local area network (LAN)

The NetBurner Ethernet Core Module is a device containing everything needed for design engineers to add network control and to monitor a company's communications assets. For a very low price point, this module solves the problem of network-enabling devices with 10/100 Ethernet, including those requiring digital, analog and serial control.

MOD5270-100IR.....$69 (qty. 100)
MOD5234-100IR.....$99 (qty. 100)
MOD54415-100IR.....$89 (qty. 100)
NANO54415-200IR...$69 (qty. 100)

NNDK-MOD5270LC-KIT.....$99
NNDK-MOD5234LC-KIT.....$249
NNDK-MOD54415LC-KIT.....$129
NNDK-NANO54415-KIT.....$99

NetBurner Development Kits are available to customize any aspect of operation including web pages, data filtering, or custom network applications. The kits include all the hardware and software you need to build your embedded application.

- **For additional information please visit**
  http://www.netburner.com/kits

NetBurner
Networking in One Day!

Information and Sales | sales@netburner.com
Web | www.netburner.com
Telephone | 1-800-695-6828

freescale™
Alliance Member

EasyPIC v7 with click™ boards makes perfect match for any project you are working on. Just place your click board into the mikroBUS™ host socket and it's ready to work straight away. Adding new functionality to your development board was never so easy!

MikroElektronika
DEVELOPMENT TOOLS | COMPILERS | BOOKS

www.mikroe.com/click/

GET IT NOW
www.mikroe.com/easypic/

September 2014

Projects & Features

Departments

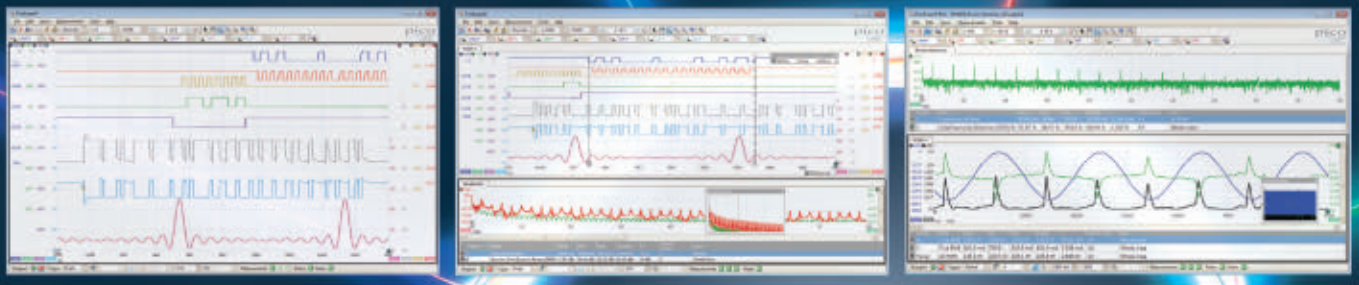
Nuts & Volts (ISSN 1528-9885/CDN Pub Agree #40702530) is published monthly for $26.95 per year by T & L Publications, Inc., 430 Princeland Court, Corona, CA 92879. PERIODICALS POSTAGE PAID AT CORONA, CA AND AT ADDITIONAL MAILING OFFICES. POSTMASTER: Send address changes to **Nuts & Volts, P.O. Box 15277, North Hollywood, CA 91615** or Station A, PO. Box 54, Windsor ON N9A 6J5; cpcreturns@nutsvolts.com.

pico Technology

7 functions of PicoScope:

1. Oscilloscope 2. Spectrum analyzer 3. Function generator 4. AWG
5. Logic analyzer 6. Serial protocol analyzer 7. Automatic waveform test

8 CHANNEL PC OSCILLOSCOPE



For just $2300

- High resolution
- USB powered
- Deep memory

INCLUDES AUTOMATIC MEASUREMENTS, SPECTRUM ANALYZER, SDK, ADVANCED TRIGGERS, COLOR PERSISTENCE, SERIAL DECODING (CAN, LIN, RS232, I²C, I²S, FLEXRAY, SPI), MASKS, MATH CHANNELS, ALL AS STANDARD, WITH FREE UPDATES

12 bit • 20 MHz • 80 MS/s • 256 MS buffer • 14 bit AWG

www.picotech.com/pco526

Happy Halloween

So, you may have noticed that the issue currently in your hands is a bit ... different. We're trying something new — something maybe even ... scary! A Halloween spectacular so exciting that even our magazine cover is wearing a costume! Okay, so yes, we realize it's only September, but we're starting extra early this year. We want to make sure you have ample time to ramp up your Halloween and act on the cool ideas and projects in this issue!

Wait a sec! Is this issue all Halloween instead of electronics? Nope. We're still *Everything for Electronics*. It says so right there on the cover. And you know what? From our (somewhat biased) perspective, Halloween is all about electronics. Electronics unifies the entire issue and every article in it.

For example, in the article, "**What Do You Want On Your Tombstone?**" Len Shelton of Probotix uses a stepper motor operated/computer controlled CNC machine to demonstrate 2.5D CNC: a process where manual finishing is combined with pocketing and profiling operations to create the look of 3D contoured parts. In "**Automating Your Haunt Using PICAXE Microcontrollers**," Steve Koci gives you a guided tour to using the PICAXE microcontroller for randomized servo motions, reading sensors, and creating eerie animations.

In "**Build the Peek-a-Boo Ghost**," Kevin Goodwin shows how to make this cute animatronic desktop decoration using only a couple of servo motors, an inexpensive microcontroller, and a handful of readily available parts. Jamie Cunningham reveals the secrets behind the ever popular "**Monster in a Box**," showing how the Propeller microprocessor is well suited to driving relays, stepper motors, and sound effects all at once.

Jake Morrison takes you "**Behind the Boo With Scare for a Cure**" and shows us the tech it takes to put on a consistent, professional level haunt night after night. Don Powell provides the long awaited guide to building "**Ruby's Flame**" — an extremely realistic safe flame effect using a modified PC power supply, high brightness LEDs, surplus cooling fans, and a bit of silk. Shannon Chappell shows you "**The Inner Workings of the Rock Golem**" and tells you what it takes to make a monster, while Graham Best describes how classic animation techniques pioneered by Walt Disney and Hanna-Barbera can be put to use with microcontrollers and LED lights.

Maurice Cedeno tells the tale of his "**Crypt Creature**" — a prop that displays an amazing amount of animation from just a few relays and a single drive motor, while Marvin Niebuhr uses his "**Trio de los Muertos**" prop to show how just a couple of motors and a bit of psychology can create the perception of purposeful motion.

And that's not all! We've included a Halloween event calendar to keep you in the know about spooktacular events year round; "**Haunting 101: The Basics of Boo**" to help you get started applying your electronics know-how to Halloween projects; and even a guest editorial from industry icon Leonard Pickel. It's all here ... from the Nuts to the Volts!

So, to recap, no we are not becoming a Halloween magazine. It's still us behind the spooky mask! We're simply expanding to embrace a new hobby field that has the same interests and needs we do; namely, using electronics to make cool things. We really hope that you get a charge out of this month's issue. We spent a lot of time and put in extra effort to lure in new writers, find amazing stories, document cool projects, and showcase some new advertisers. This year, you really have no excuse for not making it the best Halloween ever!

Truth is we've been extra busy little monsters and have even held back a few surprises for next month. Hint: A much-missed column is about to make a triumphant return and a popular project is coming back bigger, better, and stronger than ever!

We hope you have as much fun reading this month's magazine as we had making it, and would love to hear your comments. Feel free to contact me directly at **VernGraner@NutsVolts.com**.

For now, get out there and get started making this the most electrifying Halloween ever!

Vern Graner
VP of Operations

NUTS AND VOLTS
EVERYTHING FOR ELECTRONICS

Published Monthly By
T & L Publications, Inc.
430 Princeland Ct.
Corona, CA 92879-1300
(951) 371-8497
FAX **(951) 371-3052**
Webstore orders only **1-800-783-4624**
www.nutsvolts.com

Subscription Orders
Toll Free **1-877-525-2539**
Outside US **1-818-487-4545**
P.O. Box 15277
North Hollywood, CA 91615

FOUNDER
Jack Lemieux

PUBLISHER
Larry Lemieux
publisher@nutsvolts.com

ASSOCIATE PUBLISHER
Robin Lemieux
robin@nutsvolts.com

EDITOR
Bryan Bergeron
techedit-nutsvolts@yahoo.com

VP OF OPERATIONS
Vern Graner
vern@nutsvolts.com

ADVERTISING SALES
Garry Moore
adsales@nutsvolts.com

CONTRIBUTING WRITERS
Graham Best
Len Shelton
Steve Colberg
Steve Koci
Jake Morrison
Marvin Niebuhr
Don Powell
Melissa Shelton
Shannon Chappell
Jamie Cunningham
Kevin Goodwin
Maurice Cedeno
Leonard Pickel

CIRCULATION DEPARTMENT
subscribe@nutsvolts.com

SHOW COORDINATOR
Audrey Lemieux

WEB CONTENT
Michael Kaudze
website@nutsvolts.com

WEBSTORE MARKETING
Brian Kirkpatrick
sales@nutsvolts.com

WEBSTORE MANAGER
Sean Lemieux

ADMINISTRATIVE STAFF
Debbie Stauffacher
Re Gandara

For this first special Halloween edition of *Nuts & Volts*, we asked haunting legend, Leonard Pickel "What drew you into haunting?"

I come to haunting from a completely different direction that most of my colleagues ... many of whom have some theatrical or set building background. I didn't start out as a home haunter and grow into the pro ranks like many others. I also come to the horror genre a lot later in life than most haunters, not getting into haunting until I was an architecture student in college. My interests in fright-themed attractions are as it pertains to an architectural design problem.

Almost by accident, I volunteered to create a haunted house for the dorm I lived in at Texas A&M University. Only open for two nights and at fifty cents per person, I borrowed props and masks from fellow students. With a $300 total budget, we grossed $1,000. I seemed to have a talent for scaring people, and while I was still focused on my architectural career, I thought haunting might be fun to do for profit someday.

I apprenticed at architectural offices in Dallas, TX after graduation, and became a volunteer for the March of Dimes Haunted House fundraiser which was the biggest Halloween event in the area at the time. As four-year chairmanship of the event, I designed March of Dimes haunts for Dallas, Ft. Worth, and Plano before resigning and opening up my own attraction.

My first haunted attraction was built on credit cards and pocket change. At the end of the first season, I was $20,000 in debt which I thought was a huge failure, not realizing what I preach today: Haunting is a business like any other and takes 3-5 years to make a profit. (Looking back, I should have taken a business class or two rather than those basket weaving type electives.)

Working in an architect's office, I discovered that all of the fun design is done by the firm's principals. The rest of us were just intelligent copy machines, redrawing details for each new configuration. However, I wanted to be a designer and I had so many people approaching me to create haunted houses for them, that I started the company Hauntrepreneurs ® in 1987 and went to work for myself.

What really drew me to haunting is the freedom of creativity it brings. Each theme, each setting, each attraction I have built has been very different. Haunted attraction architecture has so much more impact on the people that experience it than the hotels or strip malls I was designing in architect offices. Plus, I get to see people's reactions.

The haunt experience is unlike any other kind of entertainment. The patron is thrust into a fight or flight situation and has no idea what will happen next. Their lives are literally in the hands of the designer, making safety a huge concern for building officials and owners alike.

It is not like I threw my degree away. I still deal with building and fire codes and architectural design. I just take what I learned about making people feel comfortable in a place and do the opposite.

Guest Editorial by Leonard Pickel

When I first started haunting, the industry had just graduated from making people put their hands in peeled grapes for eyeballs and cold spaghetti for brains. Many attractions were still using guides to show people through heavy gore and even Satanic experiences. My approach was more like the Disney Haunted Mansion Doombuggies that never stop. I developed a low gore, low theatrics, high startle, high capacity scare forward design approach that I still use today.

Over the 27 years since, the industry has undergone massive changes. Charity haunts like those of the March of Dimes have all but faded away, unable to compete with for-profit attractions with big construction and marketing budgets. Ticket prices have increased dramatically as has the level of scenic quality and technology utilized in today's attractions.

Innovations like pneumatic animations and controllers bring scary props to robotic life. New materials like silicone and foams create more realistic sets and more lifelike props and masks. Airbrush makeup drastically increases the quality and speed of turning staff into frightening live characters. Low voltage LEDs have revolutionized attraction lighting and lowered electrical power requirements for a haunt.

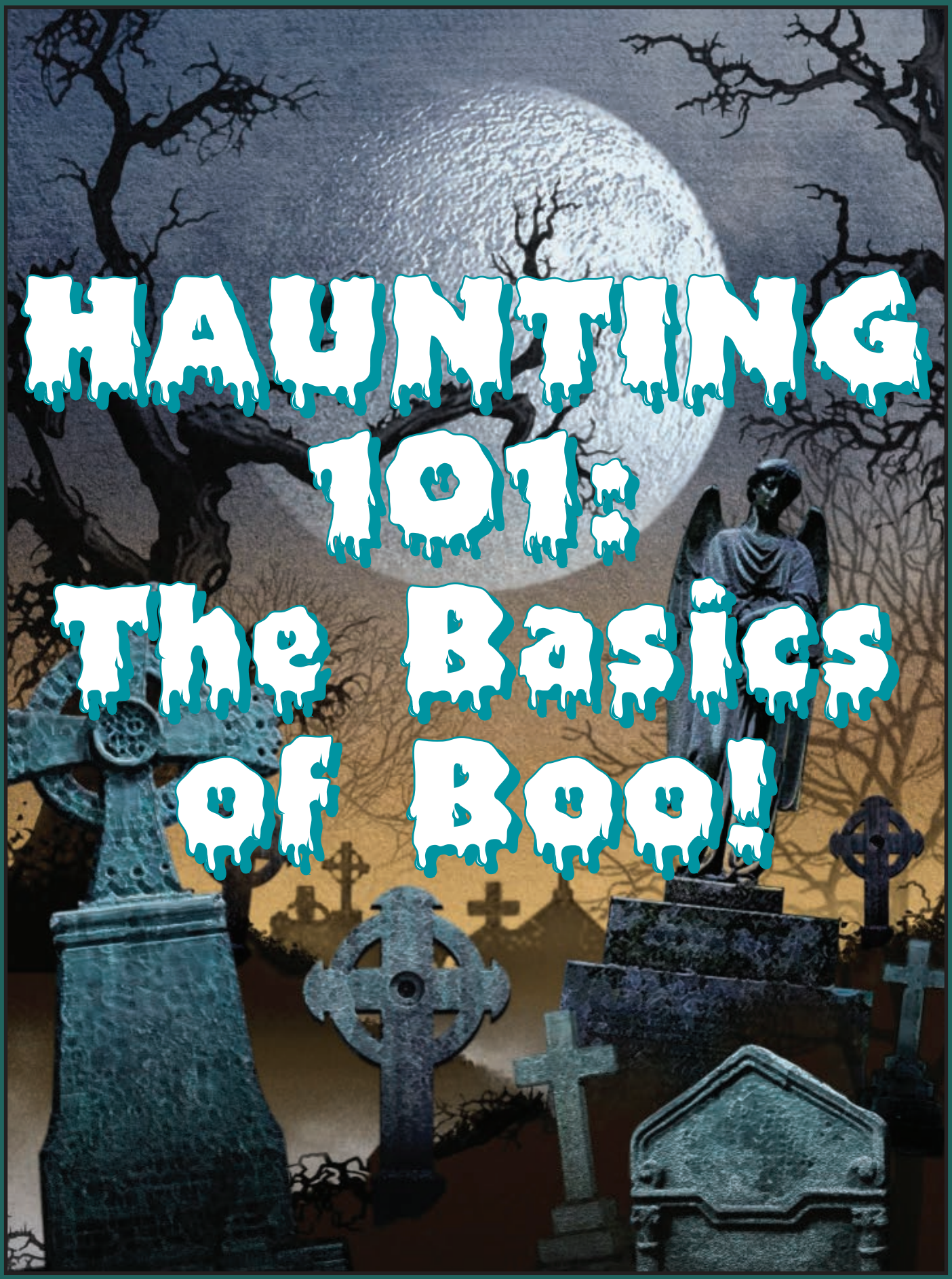
Each new technology that comes on the market is quickly hacked by haunters and turned into something scary, putting haunted houses on the cutting edge of development for theatrical experiences. The Internet has become a vast educational treasure trove of ideas, methods, and videos sharing everything from scenic painting techniques to do-it-yourself animatronics how-to's.

With so much free information, haunting has risen to a level never before seen, and that trend will continue for the foreseeable future. Attendance to haunted attractions has continued to increase year after year for most events, with weather and the success of the local baseball team the biggest unknowns to deal with.

Haunting is a great deal of fun but it is not a "get rich quick" scheme. If done properly, a haunted attraction can be a very profitable and creative outlet for the right owner. Done incorrectly — underfunded, poor quality — it's a bankruptcy waiting to happen. If it was easy, everyone would be doing it.

Haunters are always looking for the next level of fright, and the newest trend in haunting are the "Alone" style haunts where people go though the attraction by themselves, are verbally abused, physically grabbed, and asked to do disgusting things to make it through. Not exactly my style of haunting, it will be interesting to see if this trend is a fad or a lasting change to the industy, but this approach is nothing new. It's just an over-the-top version of peeled grape eyeballs and spaghetti brains. **NV**

Leonard Pickel is owner of **Hauntrepreneurs.com** — a themed attraction design and consulting firm — and **HAuNTcon.com** — an educational conference for the fright attraction industry. You can contact him at 972-951-5100 or by email at leonardpickel@gmail.com.


HAUNTING 101:
The Basics of Boo!

By Steve Koci

Post comments on this article and find any associated files and/or downloads at www.nutsvolts.com/index.php?/magazine/article/september2014_Haunting101.

So, you've decided you want to haunt. Well, good news! We've gathered together 13 "lucky" ghoulish projects that are the perfect place to begin your new scary endeavors. The list includes info from a variety of sources including online forums, YouTube videos, and individual websites. Not only are we bringing you the info you need to build these props, but we just might introduce you to some sources and haunters you haven't discovered yet! To help get a feel for what it takes to do projects such as these, we have conveniently rated each project for its average cost as follows:

$ - Under $50
$$ - $50 to $100
$$$ - $100 to $200
$$$$ - Over $200

Additionally, we've assigned a "spidey rating" to give an indication of how much work it would take to put a project together. One spider is given for something easily assembled, where four spiders indicate a more involved build. So, now that you know what to expect, let's check out the list!

1. Flying Crank Ghost

A ethereal figure that floats and glows when illuminated with black lights provides a wonderful prop that works equally well in a mausoleum or as a window display. This amazing mechanism was originally designed by Phantasmechanics and creates a ghostly and mesmerizing motion. It uses a low RPM motor with lines, pulleys, cheesecloth, and a foam wig head which can be attached to aluminum stock or even to a wood frame. One end of a bar is mounted to the motor and the other end to a spinning disc to which three lines are connected. As the motor rotates, it causes each line to lift at a different time, giving the prop its distinctive movement (**Figure 1A**). Builders have taken this design and adapted it for new and interesting props. It's a classic and certainly a prop that should be considered a "must have" if it's in your budget (**Figure 1B**).

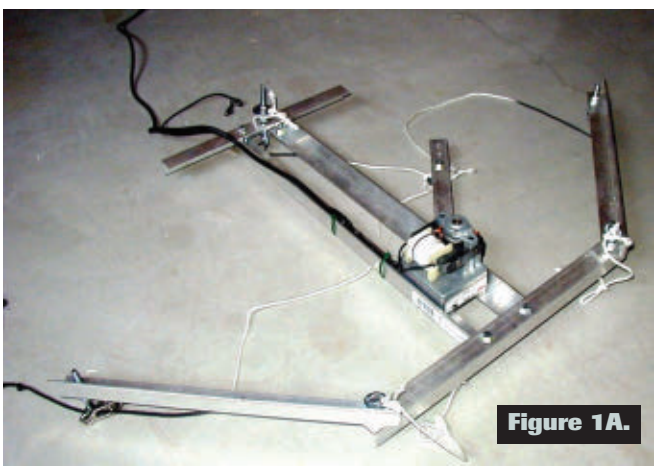


Figure 1A.

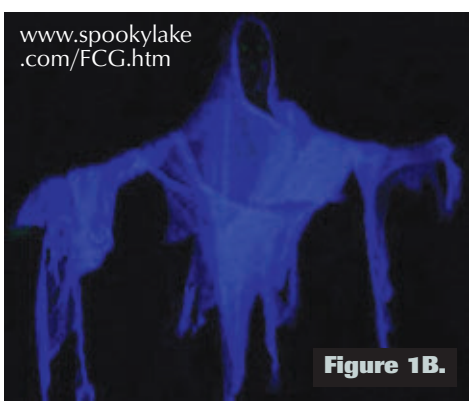


Figure 1B.

$$$

Figure 2.

2. Tombstone Peeper $

There are many variations of this popular prop that can put most low RPM motors to good use. The easiest one may be the motor used to move Christmas reindeer. It takes the simple circular motion of the motor that — when connected to some aluminum bar and run through an eyebolt — creates a side to side motion of a prop head or skull that works great when placed behind a tombstone (**Figure 2**). This is an inexpensive and quick build that's perfect for anyone designing their first animated display.

Figure 3.

3. Fog Chiller $

Nothing compliments a ghoulish graveyard like slow moving/ground-hugging fog. The problem is that the majority of fog machines use heat to create the effect, so it tends to rise and then dissipate. A great way to counteract this problem is to build a fog chiller which will cool the fog and help keep it near the ground. While there are many different designs of fog chillers, one of the easiest to build (and still be very effective) models can be made from the plastic containers used to sell kitty litter and a few parts from the hardware store. Some more complex models use water circulation pumps and small fans to move the air past pipes containing chilled water.

In all of these, the underlying principle is the same: Fog enters the chiller and proceeds through the piping in the ice filled container (**Figure 3**). By the time the fog exits the chiller, it has had time to come down in temperature which allows it to hug the ground and stay in your haunt longer. This simple project can be put together in an hour or two, and will tremendously improve the effectiveness of your fog machine.

Figure 4.

4. LED Lighting $

Every haunt needs lighting and it's often one of the most overlooked aspects. With a little preplanning, guests will be able to see and enjoy all the hard work you've put into building your props. As your haunt grows, you may need to start searching for ways to conserve power. Why not start out using LED (light emitting diode) lighting which offers long bulb life, saves energy, and can be operated at low voltage? If soldering is not your thing, you can save some time and effort by purchasing the LED lights with the appropriate required resistor already attached. A surplus computer power supply which you may even have left over from an old computer works great for running haunt lighting (**Figure 4**). Making your own spot and flood lights can keep the cost at a reasonable level, and still provide all the benefits of the more expensive ready-made lights currently available.

5. Trash Can Trauma

An ordinary trash can is transformed into a totally unexpected surprise when strategically placed outside your haunt. This prop makes a great introduction for someone interested in entering the wonderful world of pneumatics. You mount the pneumatic cylinder vertically inside the can with the base mounted to the bottom and the top attached to a head or skull. When activated, the head pushes up the lid which is either attached to the can with a hinge or mounted to the top of the head, causing your prop head to lift the lid and pop out (**Figure5A**). It's a fairly straightforward build and there are even kits that come with all the parts necessary to assemble the mechanism.

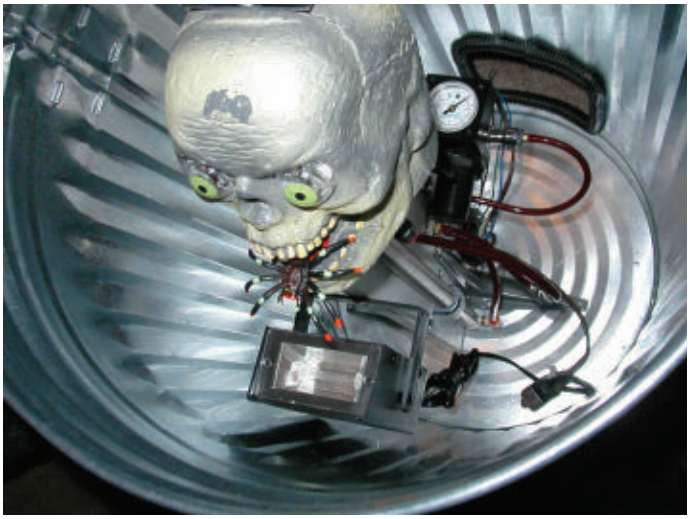


Figure 5A.

Figure 5B.

$$$

6. Casa Fear Groundbreaker

The groundbreaker is a crowd favorite that also uses pneumatics to create a great scare. This fantastic prop was designed by (you guessed it) those at the Casa Fear Haunt. It uses two cylinders attached to a wood or steel hinged frame to animate a character that appears to be trying to rise from the grave (**Figure 6A**). Covering the frame with some tattered clothes and adding a zombie mask makes it a perfect addition to any graveyard scene. When the mechanism is combined with a loud and scary audio track along with a controller, it creates a very active and violent motion that will terrify all who pass by. The erratic motion gives it a wild and unpredictable movement that is unlike any other prop (**Figure 6B**).

$$$

Figure 6A.

Figure 6B.


Figure 7A.

7. Cauldron Creep

This is a wonderfully spooky improvement to the standard stirring witch. Credit for coming up with this design goes to Devil's Chariot who provided a great tutorial for building your own creep. It uses cheap and easy to get PVC, a wiper motor, and a lighter torque/low RPM motor to create an action that is creaky and just a bit disturbing. The build process is primarily cutting pieces of PVC and assembling them to form the framework (**Figure 7A**). A little adjustment when installing the motors may be necessary to get exactly the motion you like but that's totally up to your personal taste. Add a cauldron and choose either the original that utilizes a skeleton or add a costume such as a witch or witch doctor. This great prop is perfect to add to a wide selection of scenes in your haunt (**Figure 7B**).

$$


Figure 7B.

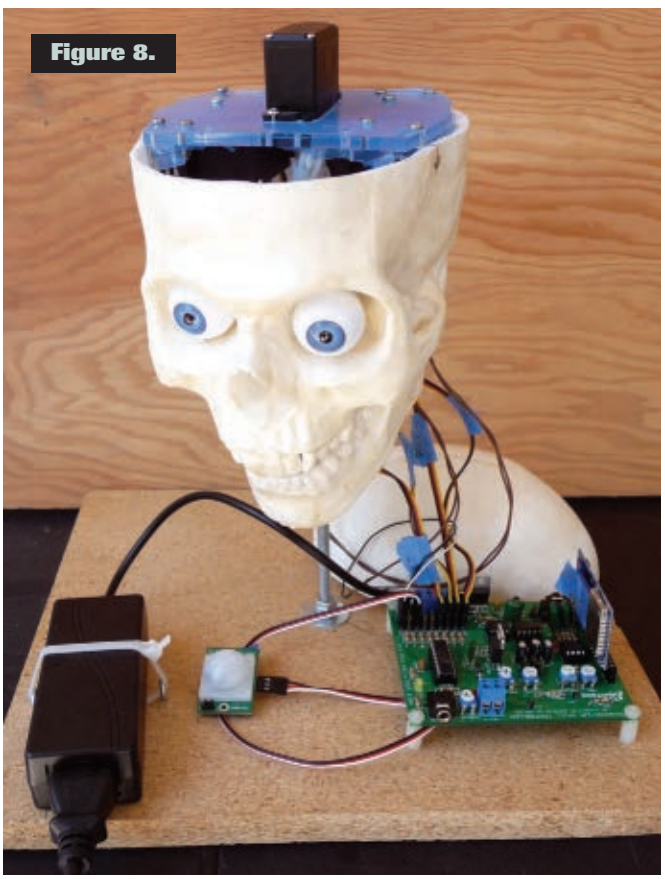


Figure 8.

8. Three-axis Talking Skull

$$$$

Here's a more advanced project, but well worth the effort. Having a character's head moving while talking to your guests is a real showstopper. Although there have been many different designs, the popularity of this prop seems to have really taken off due to the work of HalloweenBob. The 200+ page forum thread that detailed his and others work showed that this was a project attainable by the home haunter. It requires taking a lightweight plastic skull and installing four servos. These servos — which are mounted to a plastic plate — will allow the head to rotate, tilt, and nod, and will also give the skull the ability to move its mouth to match an audio track.

There are two choices when it comes to deciding how the head will move. The easier and less expensive method has the head moving in a random fashion. For most haunts, this is perfectly acceptable and creates the illusion of a live character that we're after. However, you can also program the individual motions of each servo to get exactly the head action you want. This method requires more hardware, software, and expense, as well as the willingness to devote the extra time for the programming. In some instances, it's absolutely necessary. Who wants a guitar player in a haunted band that can't move his head to the beat of the music? Using either method, it's a more advanced build, but new products are making it quicker, easier, and less expensive to put together (**Figure 8**).

9. Rocking Character

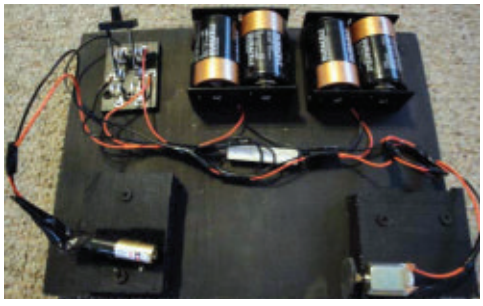
A character can be brought to life by adding a wiper motor to a rocking chair. One of the more popular methods for achieving this was created by the folks at ScareFX. Their easy-to-follow tutorial shows how you can add a little lumber and a few pieces of hardware to a wiper motor to produce a smooth rocking motion. The motor moves the hinged framework that the body of the character attaches to and causes the chair to rock in a very realistic fashion (**Figure 9A**). You can take your pick of costumes as this works equally well with a skeleton, granny or grandpa, or even a pirate (**Figure 9B**).


Figure 9A.

$$


Figure 9B.

Figure 10A.



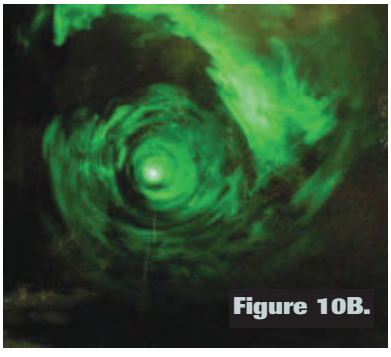


Figure 10B.

10. Laser Vortex

This is a stunning effect that — when used in combination with fog — creates a wonderful swirling laser light effect. A small mirror is attached just a little off center to either a fast spinning motor or fan (**Figure 10A**). When the laser is reflected off the mirror, it produces a cone shaped tunnel of light which will amaze your guests and will keep them talking about your haunt long after Halloween is over (**Figure 10B**). Care needs to be taken to insure that your guests are not looking directly into the laser and that you're using a properly powered one. You can find more info on laser safety at **http://web.princeton.edu/sites/ehs/LabPage/laserpointersafety.htm**.

$$


Figure 11.

11. Thunder and Lightning Machine

$$

What says "spooky graveyard" better than thunder and lightning? It's important to incorporate items in your display that stimulate as many of the senses as possible. You can not only provide a visual blast with the lighting, but when used with a good stereo that has enough bass, you can add the "feel" of the thunder (**Figure 11**). It takes the sound from a thunder audio track and uses the different frequencies of sound to flash lights to the beat. This audio and visual effect can easily be achieved with a few pieces of hardware and your home stereo and an audio track. Included in the sidebar with links for each project is a source for some very cool thunder tracks, along with plenty of other sound effects that are free for personal use.

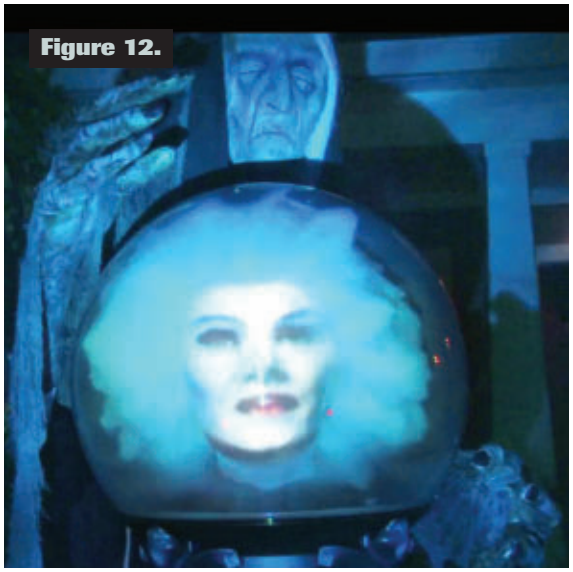


Figure 12.

12. Projections

The use of projectors is becoming one of the most popular ways of adding unique features to a haunt. Of course, it does require a projector and media player, but many of us already have these in our homes, which significantly reduces the cost of this project. Prices continue to come down and projectors can often be found used at a very reasonable cost. If you plan on buying a used unit, check the lamp life as this is the part that usually goes bad and it can be expensive to replace. There is now a wide variety of DVDs available that allow you to choose a scene that fits the theme and mood of your haunt. Make sure to check out the article in the upcoming October 2014 issue which will cover projections in much more detail (**Figure 12**).

$$$$

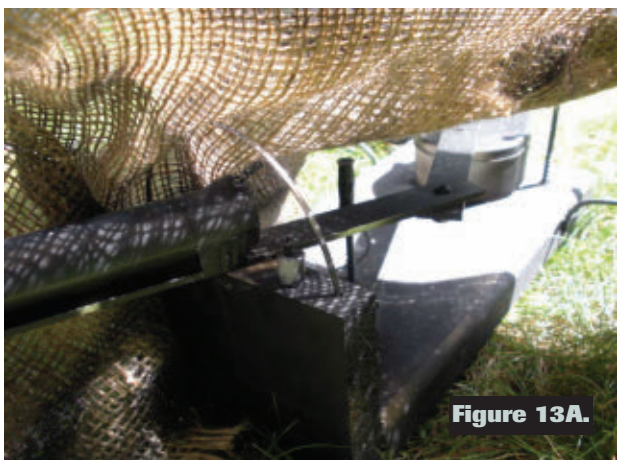


Figure 13A.

13. One-Armed Grave Grabber

$

The subtle movement of this prop will have your guests looking twice to check it out. It was initially conceived of by the Brewster Yard Haunt with some modifications done by Haunt Forum member niblique71. A reindeer motor is used with some basic components — many of which you may have laying around your workshop — to form the structure for a hand and a skull (**Figure 13A**). The frame — which consists of a few pieces of wood, some heavy wire, an assortment of screws and bolts, and a couple of lengths of aluminum bar — can be assembled with a few simple hand tools and a drill. When covered in burlap, the combination results in a sinister ghoul who relentlessly reaches out and looks up towards your guests (**Figure 13B**).

Figure 13B.

Additional prop building ideas and tutorials can be found at these ghostly sites:

Monsterlist of Halloween Projects
www.halloweenmonsterlist.info/

Omar's Haunted Trail
http://omarshauntedtrail.com/Props/props.htm

Haunt Forum - **www.hauntforum.com/index.php**

Garage of Evil - **www.garageofevilnetwork.com/**

Halloween Forum - **www.halloweenforum.com/**

Links for the 13 Projects:

1. Flying Crank Ghost - www.kickthefog.com/crank_ghost.htm
2. Tombstone Peeper - www.halloweenforum.com/halloween-prop-building-group/74930-project-1-instructor-thread-2.html *and a link to the reindeer motors* - http://kindys.com/products/decorating-accessories/replacement-motors/replacement-motor-48-animated-buck
3. Fog Chiller - http://anubiscrypt.weebly.com/uploads/1/2/9/1/12911221/kitty_chiller_2010.pdf
4. LED Lighting - www.instructables.com/id/Simple-Plug-and-Play-LED-Lighting/all/?lang=de *and* http://haunttheyard.blogspot.com/2009/08/led-spots.html
5. Trash Can Trauma - http://usersites.horrorfind.com/home/halloween/csolsen/toxic2002.html *and* www.spiderspreyground.com/howto/tct/ *and* www.evilusions.com/store/kits/trash-can-trauma-simple-pop-up-parts-kit-detail
6. Casa Fear Groundbreaker - http://youtu.be/46RycwjIvs8 *and* http://halloweenpropmaster.com/casa_fear_zombie.htm *and* www.pandemichauntproduction.com/ground-breaker.html
7. Cauldron Creep - http://devilschariot.blogspot.com/2009/08/cauldron-creep-how-to-or-how-it-was.html
8. Three-axis Talking Skull - https://www.youtube.com/watch?v=A-8IpS5hTF0 *and* http://triaxialskulllabs.com/webstore/ *and an example of a controller for it at* http://youtu.be/BaqGgtsbFkU *and the forum thread at* http://www.halloweenforum.com/halloween-props/62161-my-3-axis-skull-progress.html?highlight=3+axis
9. Rocking Character - www.scarefx.com/project_rockin_granny_2.html
10. Laser Vortex - www.garageofevilnetwork.com/profiles/blogs/laser-vortex-how-to
11. Thunder and Lightning Machine - www.ramseyelectronics.com/Ramsey-Music-Lights-Kit/dp/B0002NRKFS?field_availability=-1&field_browse=8159298011&id=Ramsey+Music+Lights+Kit&ie=UTF8&refinementHistory=brandtextbin%2Csubjectbin%2Cprice&searchNodeID=8159298011&searchPage=1&searchRank=sale *or this one* www.allelectronics.com/make-a-store/item/mk-114/low-voltage-light-organ-kit/1.html and http://therecordist.com/free-sfx
12. Projections - http://chickenhaunt.blogspot.com/p/tombstone.html *and* ww.hauntforum.com/showthread.php?t=37433&highlight=projection
13. One-Armed Grave Grabber - www.fulcrumsites.com/haunt/html/the_one-armed_grave_grabber.html *and* www.hauntforum.com/showthread.php?t=25755

There is a wide variety of choices to help you find inspiration and assistance to continue to develop your haunt so you can provide an ever-changing environment that will amaze and scare your friends and neighbors. The enjoyment we provide and the screams that come from our visitors makes all the effort we put into our shows worth it! **NV**

Build the Peek-a-Boo Ghost

I find Halloween is always a fun time of the year. In my neck of the woods, it seems more money is spent on Halloween decorations than almost any other holiday. My friends, Veronica and Don Chaney are a good case in point. It's their favorite time of the year and they go all-out decorating their house (Figure 1). I like to tease Don during the holiday by showing Veronica the latest and greatest decorations — to Don's (or actually his wallet's) dismay. I often get poked right back by him when he bugs me to build a couple of new automated creatures to add to their monster menagerie. Normally, I go into hiding at that point, but this year my friend, Vern Graner (full disclosure: he works for this magazine and is a Halloween nut too!) was showing me a couple of Halloween videos and one by Widgetwerks (see Resources) really caught my eye.

FIGURE 1.

There was a little ghost that would use its hands to alternately cover, then reveal its eyes like as with the classic children's game of "Peek-a-Boo." It was cute. Okay, it was adorable! However, what was really impressive was that it was done with industrial rotatory pneumatic actuators, solenoid valves, and a PLC. Being in the business of building packaging and production line machinery, I could tell the equipment used in the video was a bit pricey.

Vern and I discussed the project, and decided the same motions could be easily accomplished with a couple of standard servo motors and a simple microcontroller for probably $50 or less. After I added a PIR motion sensor, a sound playback board, and some LEDs for eyes, I presented Veronica and Don with their new ghost.

So, if it's way past time for you to add to your creepy collection of little Halloween horrors, it's time to build your own Peek-a-Boo Ghost!

By Kevin Goodwin

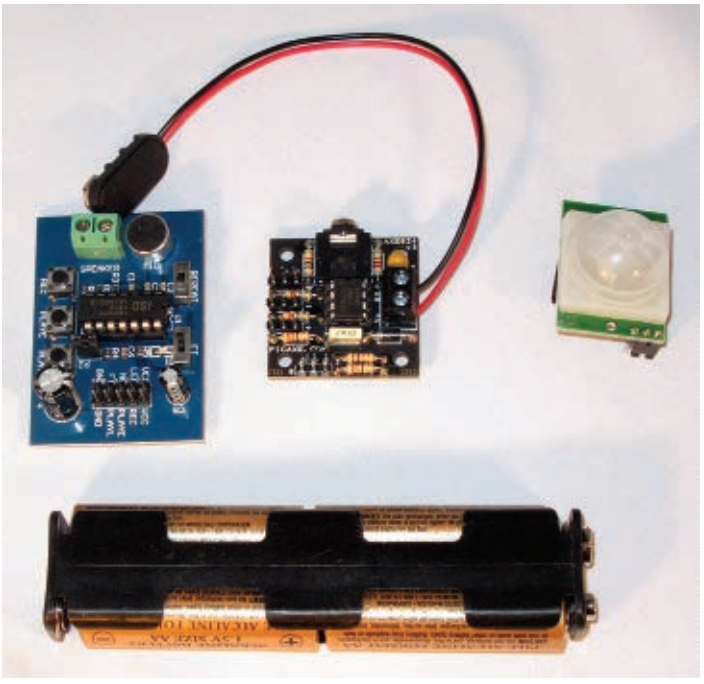


FIGURE 2. The voice card, PICAXE, and PIR sensor shown together.

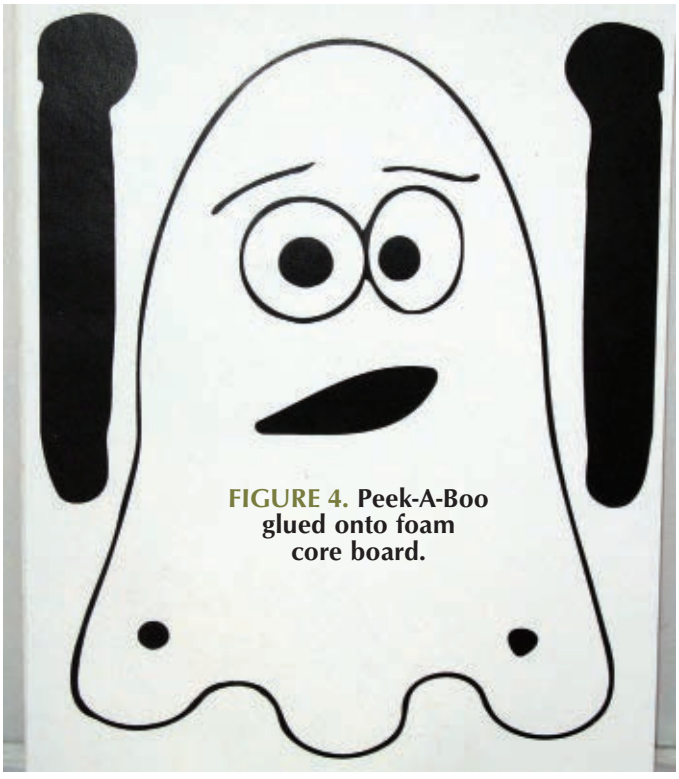


FIGURE 4. Peek-A-Boo glued onto foam core board.

Hardware Required

I wanted the ghost to be as simple as possible to make, while also being economical to acquire. I started with a trip to the dollar store and picked up quarter inch white foam board and paste glue sticks. There are other craft things you can pick up like cutting blades, colored pens, and LED lights to complete your Peek-a-Boo. The dollar store has a bunch of cool modifiable stuff on the racks for inexpensive experimenting (plus, it's all just a buck!). I picked up the other electronics (such as the PICAXE-08M2 servo control board and Parallax IR sensor) at **Robotshop.com**. For sound, I chose an inexpensive sound card based around the ISD1802 chip I purchased from **elecfreaks.com** (**Figure 2**).

The servos are typical nine gram micro R/C types I happened to have on hand. The wiring I used to connect everything up was standard servo extension wires I was able to excavate from my junk box (see **Parts List**).

Tools Needed

The tools I used are common ones that you can find in any craft store. You'll need a sharp hobby knife and cutting board or backing. (Remember, we don't want to scratch up Mom's kitchen table!) A hot melt glue gun will be needed to attach the components to the foam board. Don't forget the "usual suspects" in the electronics tool set such as diagonal cutters, needlenose pliers, soldering iron, etc., like the ones in **Figure 3**.

FIGURE 3. Tools to have handy.

Parts List for the Peek-A-Boo

Qty	Description	Manufacturer
1	PICAXE-08M2 servo driver	PICAXE
1	PIR motion sensor	Parallax #555-28027 or equiv
1	Voice sound module	LC Technology ISD1820 or equiv
2	9 gram micro servos	HobbyKing HXT900 or equiv
2	LED Ice cubes	PartyTime ice cubes or equiv
1	8 ohm PC speaker	
1	Assorted scrap PC wires	

The Art

You can download the image of the Peek-a-Boo Ghost at the article link in PDF format. Use your inner artist to take a crack at it. There are many ghosts, goblins, and witches to choose from on the Web. The nice thing about using the PDF we provide is you can make it as small or large as you want. I'm going small with the first one (11.5 x 8), but if you go to your local office supply chain, you can get them printed as large as you like.

The Build

I started by gluing the printed paper Peek-a-Boo (try saying that three times fast!) to the foam board. Use generous amounts of glue stick to attach the paper so it doesn't come off. Use a straight edge to smooth out the

FIGURE 5. Peek-A-Boo main components cut out.

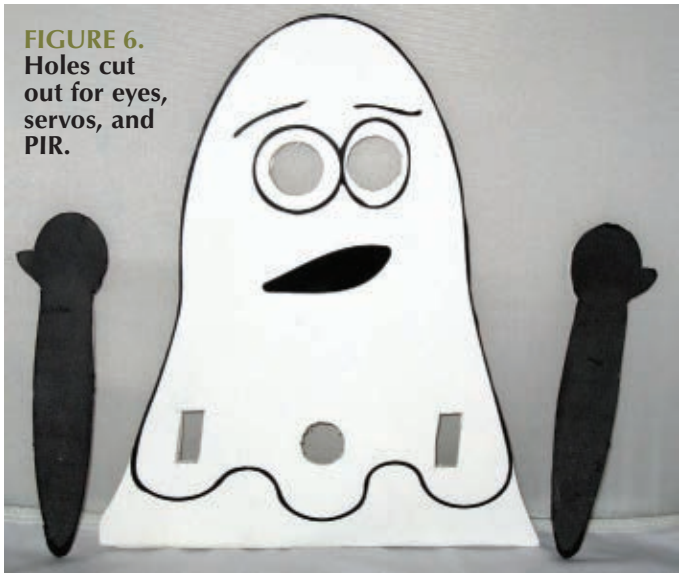


FIGURE 6. Holes cut out for eyes, servos, and PIR.

wrinkles and to secure the paper (**Figure 4**). You want to make sure that the paper sticks in the areas of the outline to be cut. The paper will drag and tear if you don't. (No big deal if it does tear. Dab a little glue on the tip of your finger and smooth it over the paper. The glue stick dries clear.)

After it dries, cut along the outside of the black line of the Peek-a-Boo, but leave the bottom because it is used as the base of the stand for the ghost. Go ahead and cut out the arms and the stands as well (**Figure 5**). Set them aside until we come to the final assembly.

At this time, gather up your IR sensor, servos, and LEDs. Outline your servos over the small black circles drawn in the lower left and right hand of the ghost pattern. Make sure that the output shaft of the servo is directly behind the black circles. Draw the outline of the servos and cut out squares. Here's where you can have a little fun.

The IR sensor I chose has a white dome as part of it. At first, I was looking at this thing and thinking, "Where am I going to put this?" Two words: belly button! (But hey, that's me.) You could put it in the middle of its forehead. It's up to you. The eyes are the same when it comes to location. Place them where you like in the eye area.

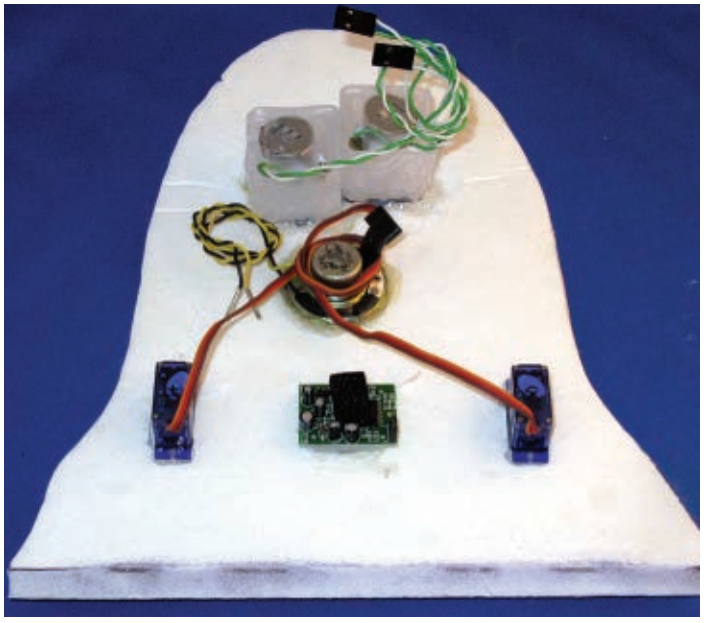


FIGURE 7. All components glued in place on the back of the ghost.

FIGURE 8. A 45 degree bevel is cut on the bottom edge.

Figure 6 shows how my Peek-a-Boo looked after I had cut all the holes.

Glueing Pieces Together

SAFETY FIRST! You are working with HOT GLUE! Please use caution when handling a hot glue gun and wear appropriate eye protection. Glue comes out at around 250 degrees and sticks to whatever it touches — especially fingers.

Depending on the servos you choose, the top of the servo may fit on the back side of the ghost. If not, place it on the front. Hot glue the arm servos in place and let it cool. On the backside of the ghost, hot glue the IR sensor in place. Be careful not to get any glue on the plastic lens because it may either melt the lens or possibly block the IR from reaching the sensor.

Hot glue the LED eyes into place. I've been playing with some party ice cubes with LEDs in them that I picked up at the dollar store. They are easy to modify for the project and it's kind of cool to watch the ghost cycle through the different colors.

When you have all the pieces glued in place, the back of your ghost should look similar to what you see in **Figure 7**.

To build the stand, bevel the bottom of the ghost at about a 45 degree angle (**Figure 8**). This will leave an even

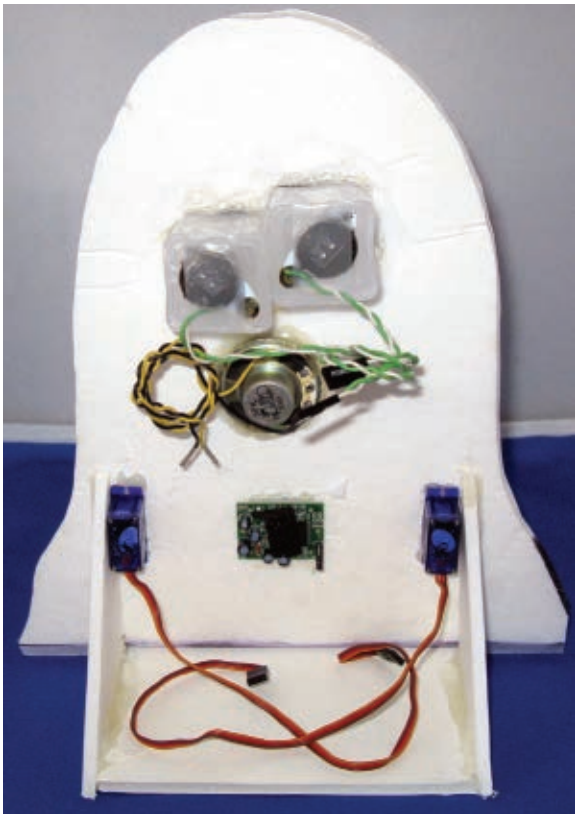


FIGURE 9. Stand glued in place, showing installation of the eyes, servos, and PIR sensor.

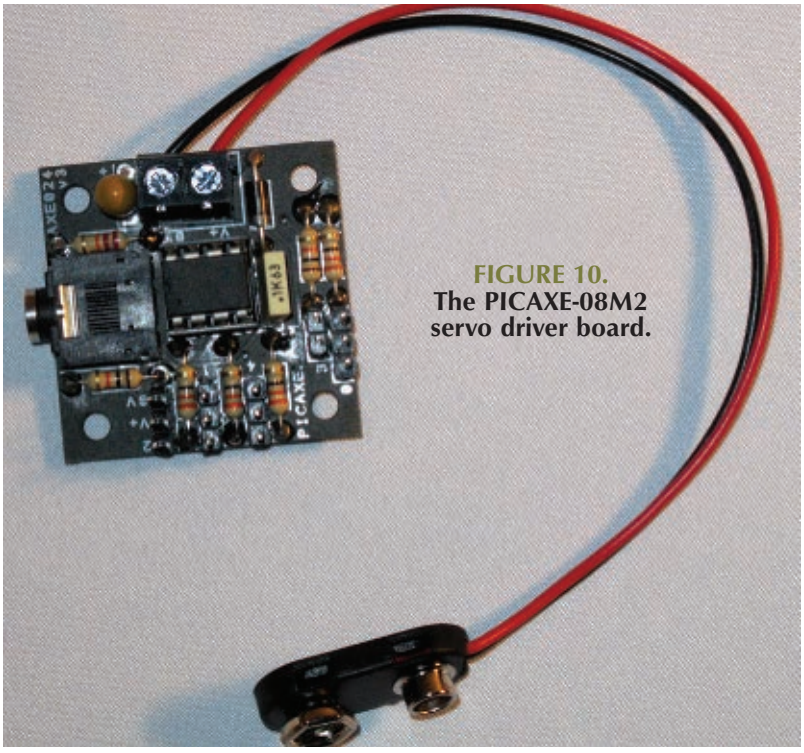


FIGURE 10. The PICAXE-08M2 servo driver board.

and clean look when the Peek-a-Boo is resting on the ground. Glue the stand as shown in **Figure 9**. The stand helps with a couple of things. First, it keeps the ghost upright, and second it's a neat place to hide the electronics. Also, the weight of the batteries and electronics keep the ghost from tipping forward. Now that we're done building our ghost, let's get him wired up and moving!

Hardware Description

The processor I've chosen is the PICAXE-08M2 mounted on a servo driver board kit (**Figure 10**). It is an inexpensive four-output version with one input carrier board which is a perfect fit for this project. The board has four "servo" style three-pin connectors. The servos connect to ports 0 and 1, the sound board to port 2, and the LEDs to port 4. Servo extension cables work perfect here. I used some leftover PC parts to connect the LED eyes and to provide a speaker for the sound board.

The Parallax model #555-28027 (**Figure 11**) is a passive infrared motion sensor. It's a simple discrete TTL/CMOS output device that can detect motion up to 20 feet. It's an easy device to connect to the board using either a female to female servo extension or simple .100 experimenter's jumpers. The pin configuration is the same as a servo with a ground pin, positive pin, and output signal. I connected this sensor to port 3.

The last item to hook up is the LC Technology sound playback card (**Figure 12**). This is a cool little easy-to-use device that allows you to record up to 10 seconds of

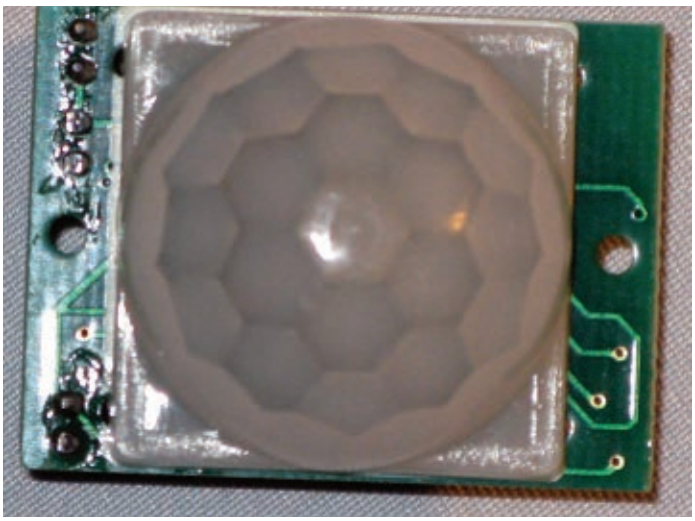


FIGURE 11. Parallax's passive infrared motion sensor.

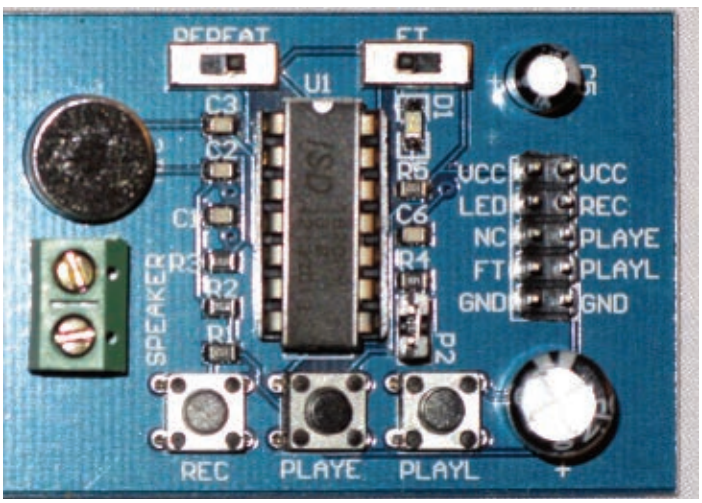


FIGURE 12. The LC Technology voice card.

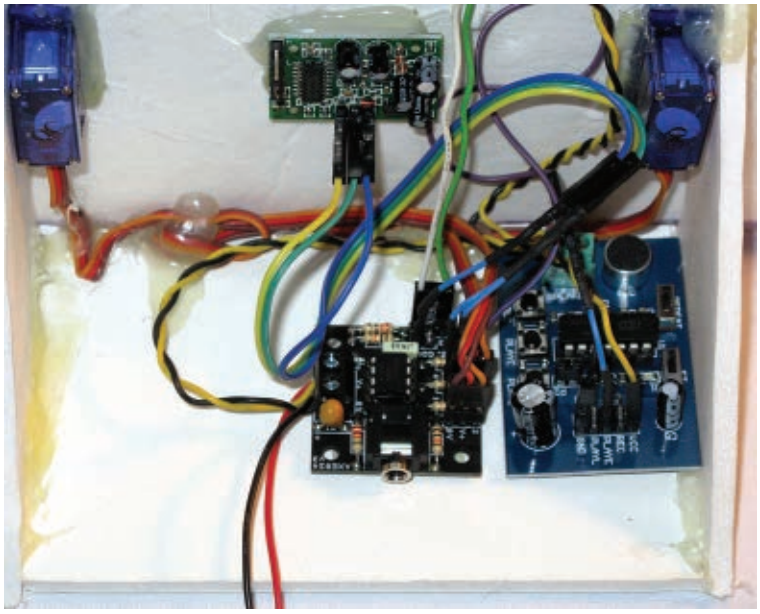


FIGURE 13. The major components mounted on stand.

audio using the built-in microphone. There's a complete description of the board features and interfacing details online, but for our purposes I just connected VCC, ground, and PlayE. The PlayE is a "one shot" activation signal from an external source. The PICAXE board takes this pin from LOW to HIGH, then back to LOW to cause the entire recording to play. Once I had power connected, it was simple enough to record myself saying "Peek A BOOOOoooo!" in a high squeaky voice. I then used the convenient onboard buttons to play back the audio to make sure it worked. Though the board can directly drive the small speaker, in my opinion, you will likely need to run the output to an additional small amplifier if you plan to use your ghost in a loud area.

RESOURCES

Peek-A-Boo video
www.youtube.com/Hero2000robotics

Peek-A-Boo source code:
www.nutsvolts.com/index.php?/magazine/downloads

PICAXE IDE software/hardware and manuals
www.picaxe.com/Software

Parallax PIR sensor
www.parallax.com/product/555-28027

LC Technology ISD1820 voice sound module
www.lctech-inc.com

Original inspiration for the Peek-A-Boo ghost
http://youtu.be/IVIC8VdXRiw
www.widgetwerks.com

A special thanks to my friend, Mathias Bohn for helping me with the artwork and to Widgetwerks for the inspiration!

To finish up, I hot glued the PICAXE board down with the programming jack facing backwards for easy access. I then glued the sound board right next to it. Lastly, I used some dabs of glue to hold the servo wiring in place. When you finish wiring everything up, it should look something like **Figure 13**.

Software and Programming

To program the Peek-a-Boo, I use the PICAXE Editor 6 Integrated Development Environment (IDE). It's a simple-to-use program that comes with an editor, simulator, and flowchart designer. The original flowchart editor has been replaced with another PICAXE product called Logicator. All their software and manuals for their current hardware and software are made available as a free download from their website (see **Resources**).

To program the PICAXE, your computer needs to have a DB9 or DB25 serial connector. If you don't have one of these original serial connectors on your computer (and let's face it, most modern machines no longer provide these ports), you can use a USB-to-serial adapter or adapter cable.

Revolution UK (the makers of the PICAXE) sell a PICAXE-specific USB-to-serial cable that has the 3.5" male plug on it to match most PICAXE carrier boards. This cable is available from many places, including resellers such as RobotShop, but I was able to "roll my own" by following Tommy Tyler's instructions in his article, "Building Your Own PICAXE Download Cable" in the July 2014 issue of *Nuts & Volts*.

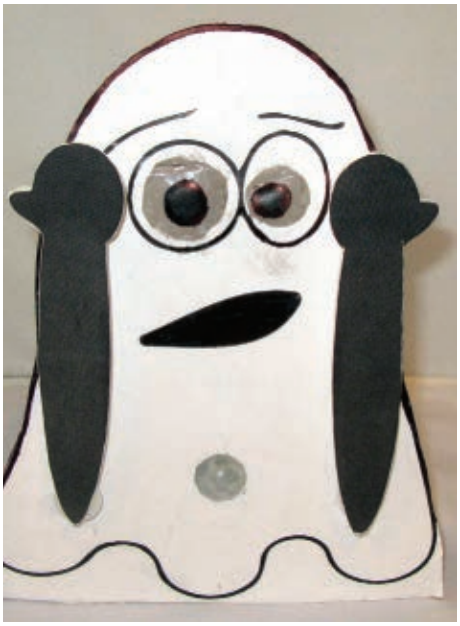


FIGURE 14A. Finished Peek-A-Boo ghost eyes uncovered.

FIGURE 14B. Finished Peek-A-Boo with eyes covered.

Peek-A-Boo Code

The Peek-a-Boo code is relatively simple in operation. I set up program constants at the top of the code to make it easy to adjust values that you will need to alter for your specific setup as shown here:

```
'*** Program Constants
symbol servo_delay = 5
' Delay to slow down servo motion (30ms default)
symbol servo_min    = 120
' \Set these values based on your servos
symbol Servo_MAX    = 180   ' /
symbol reset_PIR    = 5000
' 5k milliseconds is 5  seconds
symbol True          = 1     ' \
symbol False         = 0
' /Used for comparisons
```

This is where I set the minimum and maximum positions for the servos. I also set a PIR delay to keep the ghost from immediately retriggering if the person who set it off is still standing in front of it when the motions are complete. For program initialization, I set the position of the two servos, LED eyes, and sound board to TTL low so everything will be off before the Peek-a-Boo detects the presence of a warm body. The program has one main function and one subroutine. The main function contains a loop that waits for the PIR signal to go high. When the PIR goes high, it calls the *WAVE_ARMS* subroutine that starts the sound board trigger and causes the LED eyes to turn on. The *WAVE_ARMS* function has three *for/next* loops that cause the servos to go into motion. The one outer loop is used to set the number of arm cycles (one cycle being from eyes covered to eyes uncovered). The two inner loops are used to seek the arm servos.

The first of the inner loops counts from *ServoMIN* to *ServoMAX*, causing the servos to move the arms to uncover the eyes. The second inner loop counts from *ServoMAX* to *ServoMIN* by using the "STEP -1" parameter on the *FOR* statement. This causes the servos to move the arms to cover the eyes again. At the end of the outer loop, the program drops to the PIR wait portion to avoid retriggering. After the delay has expired, the LEDs are turned off and the program returns to the main function where it waits for the next motion detection trigger. You can add some variety if you like by creating different motion functions and counters in the program to get a variety of movements from your Peek-a-Boo. For example, you might want to try and make a routine that will make him "shiver" his arms when they are covering his eyes or make a routine that causes him to slowly uncover just one eye so he appears to "peek" out at you. There's a lot of capability in this cute little build!

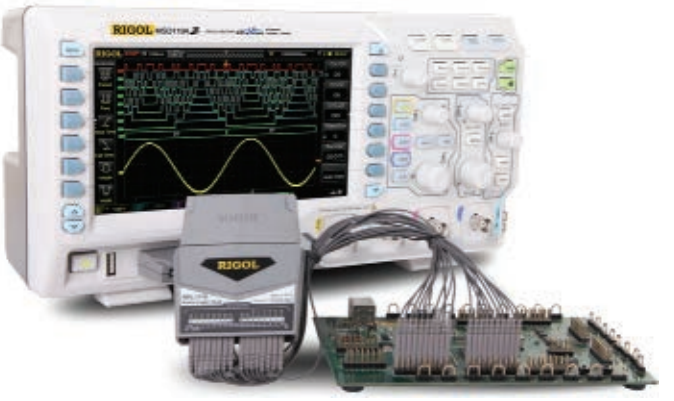
So, there you have it — a simple and inexpensive Halloween project that you can build in a couple of hours over a weekend alone or with the kids (**Figure 14A/B**). If you do create your own Peek-a-Boo Ghost, I'd love to hear from you. Also, I would love to see any code you come up with to teach your little ghost new tricks! Contact me at kgoodwin@hero2000robotics.com. Enjoy! **NV**

For those interested, a kit of parts for the Peek-A-Boo Ghost will be available in the *Nuts & Volts* Webstore.

NEW PRODUCTS

- HARDWARE
- SOFTWARE
- GADGETS
- TOOLS

MSO OSCILLOSCOPES



Saelig Company, Inc., has announced the availability of MSO functionality to their range of Rigol DS2000A and DS1000Z scopes. The mixed-signal extension provides digital signal debug capabilities to the user, allowing simultaneous viewing of analog and digital signals for comprehensive signal analysis.

Designed to reduce test time in research, development, and failure analysis applications, the MSO2000A and MSO1000Z series digital oscilloscopes facilitate detecting signal and device characteristics with comprehensive trigger functions, hardware-based real time waveform records, replay, search, and analysis functions. The multi-lingual user interface allows easy configuration of the oscilloscopes in the local language.

The analog specs are similar to the existing DS1000Z and DS2000A devices, but the capabilities are significantly extended by the addition of 16 digital MSO logic analyzer channels, enhancing debug capabilities with the capture of analog and digital signals at the same time. The digital sampling rate is 1 GSa/s for eight DIOs and 500 MSa/s for 16 DIOs. With up to 30,000 wfrm/s waveform capture rate along with the 256 level intensity grading 7" (1000 series) or 8" (2000 series) display, users can quickly identify infrequent analog events and the digital signal that may have caused or accompanied them. Trigger functions include (among others) runt, setup-hold, windows, edge, and automatic measurements with statistics. These digital oscilloscopes feature serial bus trigger and decodes such as I^2C, SPI, RS-232, and CAN bus (MSO DS2000A), as well as advanced math functions.

These MSO oscilloscopes are ideal for applications in the communications, aerospace/defense, research and education, industrial and consumer electronics, computing, and instrumentation industries. Prices start around $800.

For more information, contact:
Saelig Company, Inc.
Web: **www.saelig.com**

DC LED BARREL CONNECTOR LIGHT

The J2 LED Lighting MEL-CF (candle and flame/micro effects light) is a professional LED flame simulation light source with a built-in DC barrel type connector. The 2.1 mm x 5.5 mm barrel connector is common for many low voltage DC power applications, simplifying the building of props and scenery effects. The MEL-CF operates from 9-12 volts DC which allows for a simple effects system operating from a nine volt battery possible. More complex systems with numerous micro-effects lights

are possible from a 12 volt DC power source.

Flames are very complex light sources and can be difficult to simulate with LEDs because they are composed predominantly of a spectrum that includes blue, yellow, and orange light. The flame emission can produce a color temperature of light typically ranging from 2,100 Kelvin (K) down to 1,000K. The flame's emission varies throughout this range of color temperatures as it burns. The average color temperatures for specific flame sources are: candles - 1,900K; oil lamps or burning paper - 1,876K; and fast burning soft wood - 1,937K. Some flame source's Kelvin temperatures will decrease as they burn, such as a wood or paper fire, as light is increasingly emitted from soot, glowing embers, and residual matter more than the flames themselves.

The MEL-CF's average color temperature is 1,550K when all the light is integrated. The MEL-CF uses a proprietary broad emission luminescent resin that is coated on the inside of the emission dome in a non-uniform fashion which creates anomalies and variations in the light output color temperature for a more natural appearance and ambience. The MEL-CF has a wide spectral color content that provides rich toned specular reflections from scenery and objects.

The MEL-CF's light output is equivalent to that of a 1/8" diameter oil lamp or candle wick with a 1/2" flame when operated at nine volts, or a 3/4" flame when operated at 12 volts. The MEL-CF is optimized for high light output at nine volts DC with a nominal power of 0.18 watts operating at 20 mA ref. The MEL-CF is dimmable by either PWM type dimmers or with variable voltage input from 7-12 volts DC. The MEL-CF is well suited for various LED lighting applications such as:

- Stage scenery, props, models
- Theatrical FX, special effects flames
- Simulated candles, oil lamps, lanterns, and torches
- Simulated fires, trash barrel fires, camp fires, and fireplaces.
- Simulated burning of volatile petrochemicals

Pricing for the MEL-CF is:
One piece — $5.99 each
10 pieces — $5.75 each

For more information, contact:
J2 LED Lighting, LLC
Web: **www.j2ledlighting.com**

FULL COLOR OLED DISPLAYS

Newhaven Display International, Inc., announces full color OLED displays are now available in sizes 1.27", 1.5", and 1.69". Featuring 262K colors, these passive matrix displays have a sharper and crisper viewing quality when compared to LCDs because of their rich black levels and 2,000:1 contrast ratio. These displays also have faster and smoother graphic animations because of their 10 µsec response time.

Full color OLED displays are perfect for any industry — especially consumer and handheld — because of their low

power consumption. These unique displays also include a module containing all necessary logic. They do not have a backlight, which enables them to be 5 mm thin fully assembled. Available upon request, Newhaven Display's full color OLEDs can include a resistive or capacitive touch panel. Features include:

- 18 bit/262K colors
- 128x96, 128x128, and 160x128 resolution sizes
- >160° viewing angle
- -30 C° ~ +70 C° operating temperature
- Built-in controller
- Serial/parallel MPU interface
- 256-step brightness
- Low power
- Built-in sleep mode
- RoHS compliant

Prices start at $24.25 each.

For more information, contact:
Newhaven Display International, Inc.
Web: **www.newhavendisplay.com**

DUAL ANALOG iOS OSCILLOSCOPE UPGRADED TO LIGHTNING CONNECTOR

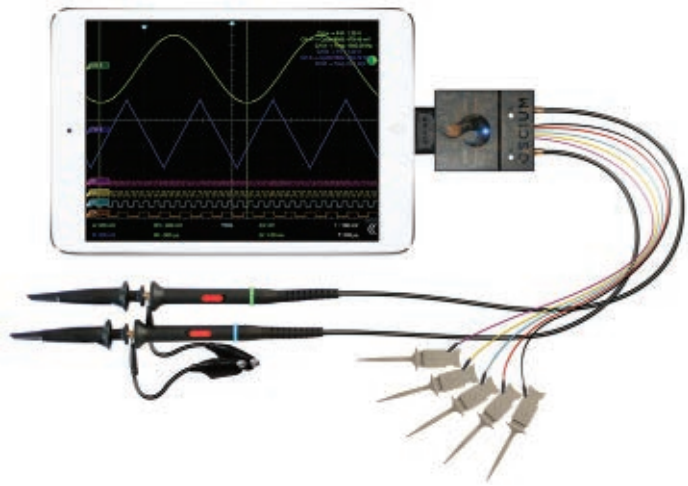
Oscium introduces the iMSO-204L — their dual analog iOS oscilloscope now with native Lightning™ compatibility. iMSO-204L transforms the iPad, iPhone, and iPod touch into an ultra-portable, two-channel oscilloscope. Since Apple changed their connector, Oscium has been working to bring native compatibility to customers. iMSO-204L is the solution to the connector change and it represents the third generation of handheld engineering tools from Oscium. iMSO-204L has the following characteristics:

- Two analog plus four digital channels
- 50 MSPS
- 5 MHz bandwidth
- 200 ns/div-10s/div

iMSO2 software features include the following:

- Waveforms can be paused and zoomed.
- Single-shot waveform capture.
- While zooming the horizontal and vertical scales, immediate feedback is provided.
- AirPlay compatibility (oscilloscope display can be mirrored onto compatible projectors). Ideal for live demonstrations in the classroom.

iMSO2 software is free in the Apple App Store. The iMSO2 app requires iOS version 5.0 or higher. Compatible products include: iPhone 5C, iPhone 5S, iPhone 5, iPad



Mini, iPad Air, iPad 4, and iPod touch [Fifth generation]. iMSO-204 hardware can be purchased for $399.97 from Oscium directly or from one of their partners.

For more information, contact:
Oscium
Web: **www.oscium.com**

LOW COST 16-BIT DAQ

Measurement Computing Corporation has announced the release of two 16-bit multifunction USB DAQ devices with sample rates up to 100 kS/s. The USB-230 Series is the lowest priced 16-bit multifunction USB devices available from MCC. They feature eight single-ended/four differential analog inputs, eight digital I/O, one counter input, and two 16-bit analog outputs. Removable screw-terminal connectors make signal connections simple. The USB-231 is priced at $249 and has a 50 kS/s sample rate. The USB-234 offers a 100 kS/s sample rate and is available for $424.

Included software options for the USB-230 Series include out-of-the-box TracerDAQ® for quick and easy logging and displaying of data, along with comprehensive support for C®, C++®, C#®, Visual Basic®, and Visual Basic .NET™. Drivers are also included for DASYLab® and NI LabVIEW™.

For more information, contact:
Measurement Computing Corp.
Web: **www.mccdaq.com**

Continued on page 97

HALLOWEEN EVENTS

February 2015

6-9 **Hauntcon**
Belle of Baton Rouge Hotel, Baton Rouge, LA
HAuNTcon is a celebration of people who love haunted houses and Halloween. The event includes three jam-packed days and nights full of networking, tours of haunted attractions, educational seminars, hands-on workshops, tradeshow, and getting into costume for the fun of it at the annual Costume Ball.
www.hauntcon.com

2/27-3/1 **Canadian Haunted Attractions Conference**
Delta Guelph Hotel, Ontario, Canada
The Canadian Haunted Attractions Conference (CHAC) is Canada's only conference dedicated to all things spooky, including Halloween, horror, haunted attractions, the paranormal, and more. This annual event features educational opportunities, a tradeshow, and special events including a Body Art Competition, Costume Ball, and Welcome Social.
www.canadahaunts.ca

March 2015

19-22 **Transworld's Halloween & Attractions Show**
America's Center, St. Louis, MO
TransWorld's Halloween & Attraction show is the ONLY industry trade show of its kind in the world. There is no other show that has as many exhibitors and industry-related products.
www.haashow.com

May 2015

1-3 **HauntX Haunter's Retreat & Tradeshow**
Circus Circus Convention Center, Reno, NV
HauntX is a haunter's retreat for Halloween lovers, pro haunters, and home haunters. Join them for a Halloween convention that is a little bit different ... great education, workshops, tradeshow, evening activities, friends, and fun.
www.HauntX.com

1-3 **National Haunters Convention & Halloween Show**
Greater Philadelphia EXPO Center, Oaks, PA
Huge national Halloween show open to the public that features everything from $5 Halloween trinkets, to home haunter supplies, to $10,000 amusement park animations. The largest cash-and-carry Halloween show in the country.
www.halloweenshow.com

15-17 **Halloween Extreme**
Double Tree Hotel, Orlando, FL
A Halloween, horror, and haunted house extravaganza like nothing you've seen before, HALLOWEEN EXTREME grants unprecedented public access to movie and theme park quality props and effects, available for the first time at the consumer level.
www.halloweenextreme.com

15-17 **West Coast Haunters Convention**
Double Tree Hotel, Portland, OR
Every May, Portland throws one of the Halloween industry's biggest parties: the West Coast Haunters Convention (WCHC) — the only convention of its kind west of the Rockies. Haunters — folks who love the spooky, scary, cobwebbing, blood splattering lifestyle associated with Halloween — gather in Portland, to buy, sell, learn, and network with others like them.
www.hauntersconvention.com

29-31 **Great Lakes Fright Fest**
Peterburg, MI
Great Lakes FrightFest is an annual haunter's get-together for home and pro haunters alike. Located at a campground in southeast Michigan.
www.greatlakesfrightfest.com

29-31 **Midwest Haunters Convention**
Columbus, OH
The Midwest Haunters Convention is the largest Halloween show of its kind in the US serving haunted attraction industry professionals, home haunters, and enthusiasts.
www.midwesthauntersconvention.com

July 2015

TBD **Florida Haunters Social/Make-n-Take**

By Steve Colberg
Scary Tinker Labs
www.ScaryTinkerLabs.com

Ocala, FL
We're here to bring the haunters and Halloween enthusiasts of Florida together like one big happy dysfunctional family!
www.floridahaunters.com

August 2015

7-9 **Kreepfest**
Harrisonville, MO
Kreepfest — like a family reunion — if you're the Addams Family! A fun, informative, and FREE gathering of haunters and Halloween enthusiasts from all over the Midwest and beyond.
www.kreepfest.org

TBD **ScareLA**
Los Angeles, CA
A weekend-long Halloween season teaser will celebrate California's hottest scary faire with attraction unveils, workshops and classes, top industry panels, haunt tours, screenings, and activities.
www.scarela.com

TBD **East Coast Haunt Club Gathering**
Manchester, NH
Whether you are a home haunter, pro haunter, in the Halloween/Haunting industry, or a fan of Halloween, the East Coast Haunt Club welcomes you! Since 1999, they have been connecting haunters and Halloween fans through gatherings, events, and networking.
www.hauntclub.net

Ever since I was a kid, I've been taking things apart and putting them back together; sometimes right, sometimes wrong, blowing fuses, and generally being intensely curious. I would always brag that there was nothing I owned which I didn't take apart to see how it worked. I never had much help or support, so I started teaching myself, finding unique ways to overcome problems for my builds through the years. About a year ago, I decided it was time to crawl out from under my rock and show the world what I was making ...

So, without further adieu, I introduce my Steampunk-inspired Rock Golem from the depths of middle Earth (a.k.a., my basement work room). This colossus measures in at 12 feet tall and weighs around 300 pounds. He is primarily built out of mattress foam over a PVC pipe skeleton.

My Golem has an impressive list of features:

- Articulated head with servo-actuated/ smoke-spewing jaws, and Larson Scanner eyes.
- Right limb hand manipulator.
- Left limb dynamically-controlled spinning energy weapon.
- A working intricate chest cavity geartrain.
- Several hundred LEDs split among several lighting effect systems.
- Fully autonomous; powered by a 12V8Ahr SLA battery in each foot.
- Wearable as a fully walking costume. An operator enters via the back panel, locks into ski boot stilts, and assumes (almost) full control of this 100% self-sufficient costume.

FIGURE 2. Skeleton of the Golem.

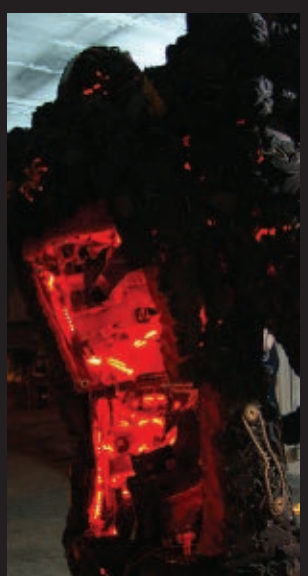
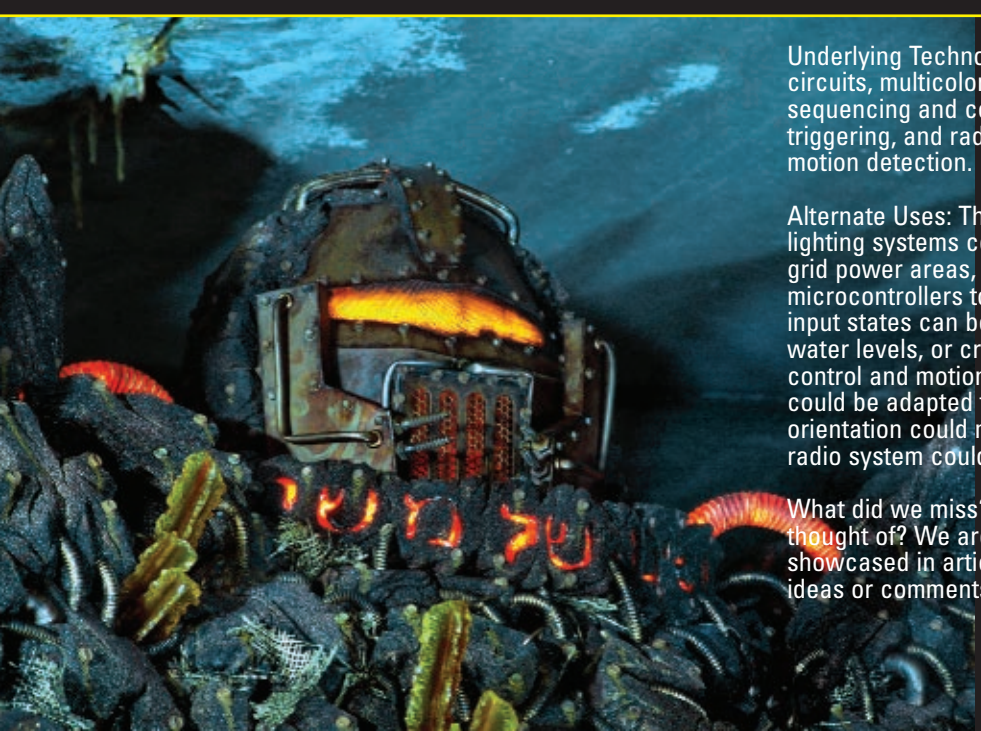


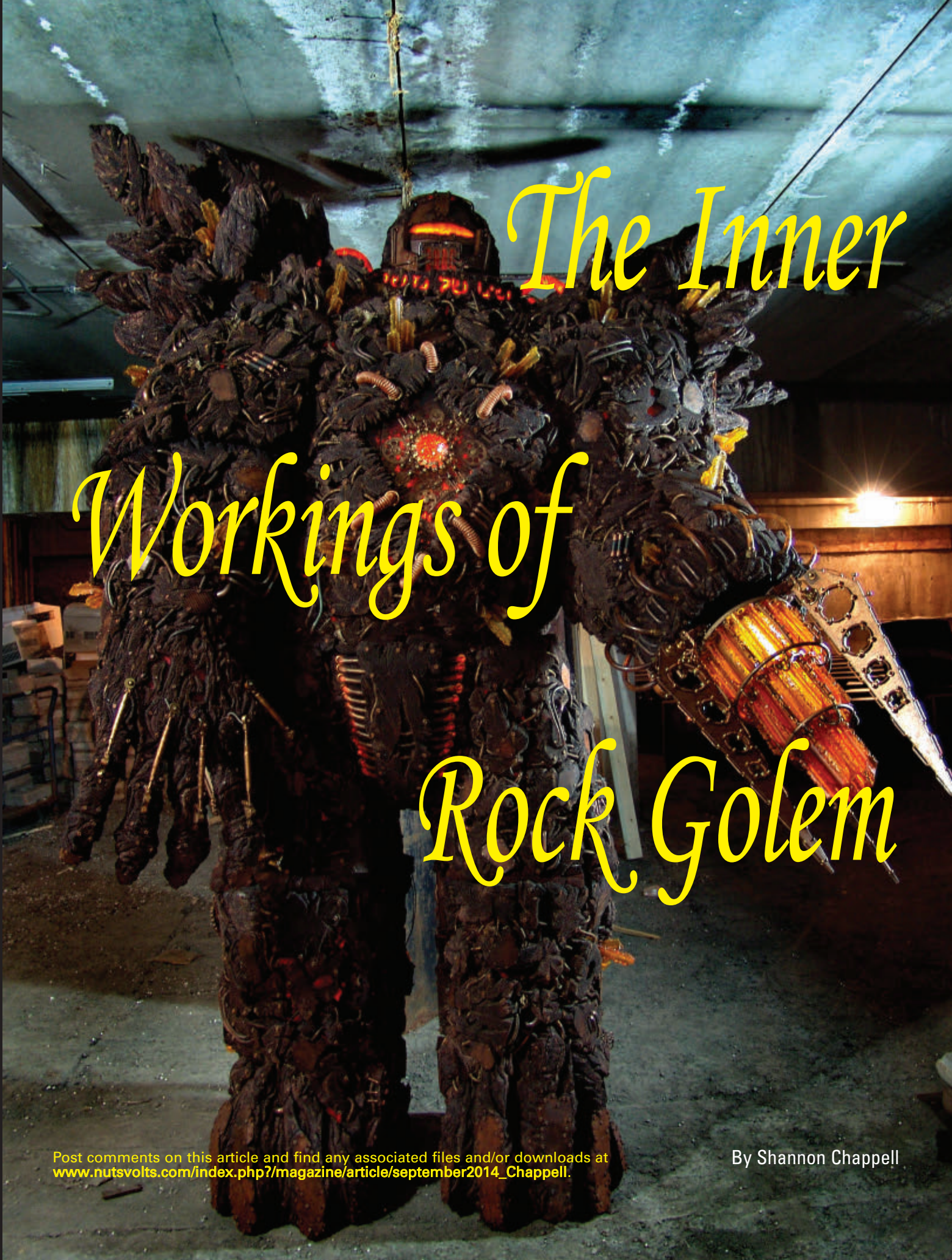
FIGURE 3. The back hatch where the operator gets inside



Underlying Technology: Power management and switching circuits, multicolor LED lighting, microcontrollers for sequencing and complex effect synchronization, sound effect triggering, and radio signal remote control via gesture and motion detection.

Alternate Uses: The power management circuits and LED lighting systems could be useful in solar power systems, off-grid power areas, and educational green energy models. Using microcontrollers to sequence or create complex reactions to input states can be useful in building alarm systems, monitoring water levels, or creating lighting macros for stage use. Radio control and motion sense systems such as the one used here could be adapted to detect a medical state (e .g., horizontal orientation could mean the wearer was incapacitated and the radio system could alert a central station about this.

What did we miss? Do you have other ideas we may not have thought of? We are interested in how the technology showcased in articles may otherwise be applied. If you have ideas or comments, please send them to editor@nutsvolts.com.



The Inner Workings of Rock Golem

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Chappell**.

By Shannon Chappell

"Why did you make this?" is the most common question I get. I had seen big costumes at events before, but I thought I could go bigger. I built it particularly for the 2013 Calgary Entertainment Exposition, but due to its size, I was denied permission to have it walk through the event. It sat in a storage room growing spider webs until I was approached by Shannon Hoover from the Calgary Mini Maker Faire, who brought us out to the light of day. Ever since, we've been delighting large costume fans.

Sketches, Designs, and the Unknown

I'd like to say I have 3D models with accurate measurements and blueprints, but I just kind of do things on the fly. So, in the instance of my Golem, I knew what I wanted as far as the height and rock-like appearance. Other than that, I made it up as I went along. The first step was to take a physical outline of the person who would be piloting it (not me) by having them stand on buckets against a wall. Tracing this general shape onto on old bed sheet gave me an initial height of approximately 10'6", so I started building a skeleton to this size.

As with any adolescent, my Golem grew a bit during his youth, adding another 18 inches to make an adult size of 12' tall. I would do some general drawings, mainly so I wouldn't forget ideas I came up with the night before.

What it Takes to Make a Golem

Lots and lots of stubbornness! Leaving the artistic stuff aside, just learning the electronics to make him come alive was quite a task for me. I am a novice when it comes to electronics, but I do have a very strong desire to learn. Most of what I know comes from years of taking things apart, hacking kid's toys, owning a copy of Forrest Mims' *Getting Started in Electronics*, and plenty of trial and error.

So, this is basically my story of how I hacked the Golem's electronics to life. Although I got it working with tenacity and determination, I knew I wanted to make it better and more reliable. So, I got some help from Solarbotics Ltd., who is also here in Calgary with us.

To make Rock Golem what I envisioned, I needed a gameplan. I sat down with Solarbotics, and we documented all the systems I had put together — including power systems and labelling all wiring (see **Figure 3**) — and what my wish list was for improvements. After prioritizing these upgrades (we were on a tight time schedule), Solarbotics' president, Dave Hrynkiw pinned down the new control structure and what the features were. Although my hacked electronics worked, they were twitchy and untunable. We decided on splitting the 15 lighting effects between two of Solarbotics' Ardweeny/Double Rainbow controllers and three SparkFun Pro Minis.

FIGURE 3. Breaking down the electrical systems for Solarbotics.

What it Takes to Make a Golem Walk

The best place to start is at the very foundation: the skeleton. Engineering a 12 foot, 300 pound costume to walk with no mechanical aid was a "feat" to say the least. (I am proud to report that the Golem never fell once.)

For the frame, I had to come up with something strong, yet light and malleable. Being that my background is in building maintenance, I decided PVC pex pipe would be the best to use. The full extent of work that went into the engineering of the skeleton was quite long, but what I did was to study how the human skeleton works and transfer the concepts to the Golem. This was actually harder than I thought it would be due to the size and the fact that someone less than half its height had to walk Rock Golem around.

After trying to use assisted walking devices such as hydraulics on the legs (which only made him lose balance), we came up with a technique where the operator was able to successfully walk the Golem around while turning his head and moving his arm and hand.

The biggest obstacle in the build process of the skeleton was attaching the energy crystal weapon which was much heavier than the rest of the costume. For this, I created strengthened joints all up the arm and upper chest to distribute the weight evenly over the upper body. This left him very front heavy though, so I designed a ratchet system spinal cord that connected his upper shoulders to one of his feet creating a core of balance, then used the Golem's own weight to balance him.

LEDs — It's an Abusive Relationship

I learned my first hard lesson on the use of current-limiting resistors. Initially, I ran two wires to every LED and many more back to a single resistor. This created a rat's nest of wiring and LED grids that were power hogs that created substantial heat in the few current-limiting resistors.

Torso LEDs

There is well over 50 linear feet of red LED strips mounted among the

Golem's internals. Each strip is cut into four-LED sections, then re-wired back together to create a single glowing effect in the cracks between the rocks. It was a very long process, but well worth the effort. The LED strips originally ran back to a standard 44-option controller (the white ones that come with most LED strips) which allowed me to create a very nice pulsing lava effect.

This same method controlled the tubes on the chest, but at a slightly different frequency. All the protruding crystals have an amber LED under them.

Rock Golem's upper back housed a small tube-shaped power cell hacked from a dollar store toy (dollar stores are where I get most of my hackable electronics). I also added wire mesh grids to give more depth and mechanical integration to the rocks. Under each grid were plastic red emergency exit signs, backlighted with flickering LEDs from electronic tea candles.

The glowing letters on the collar were created by carving them in the foam, filling them with hot glue, then embedding approximately 50 LEDs. This was the first place that I appreciated the benefit of series-wired LEDs rather than parallel ones.

The Crystal Energy Weapon

This is the centerpiece of the Golem. It is designed to spin the outer three blades around a central "power core." The weapon's power core light show consists of a column of 14 rings of eight LEDs each, surrounded by an array of individual LEDs illuminating the edge crystals.

The original plan was to show the weapon "charging" via the rings pulsing sequentially in increasing frequency, but until that animation was ready, I set it for a steady "on" which was a bad idea — 112 low-efficiency orange LEDs draw substantial power.

Don't try to run four amps through a single strand of telephone wire! It glows and melts every wire in the bundle next to it! For that matter, avoid using telephone wire in any circuit where there is a chance it will flex — this stuff is brittle.

The mechanics behind the spinning outer blades were based on the bearing system from a ceiling fan. The effect I hoped to achieve was that as they spun faster, they would create an electrical charge that would seem to power the crystals. I used a 12 VDC drill mounted to a hand-cut wooden 3:1 gear reduction system that was attached to the ceiling fan assembly. The drill's gearmotor assembly was cut from the handle/trigger portion, and motor wires were extended.

With the trigger easily hand-reachable, the pilot could slowly pull the trigger and have the blades ramp up to full speed (see **Figure 4**). This was effective and worked quite well, but the drill gearmotor was overloaded and pulled lots of power, rapidly killing the batteries.

This was corrected later with the help of Solarbotics when we replaced the drill with a much higher geared unit.

FIGURE 4. The interior of the weapon arm, with the drill mounted and made accessible to the operator.

The Head of the Golem

I wasn't sure on how to approach the head. I had built one out of rock, but found it was not suited to the rest of the Golem, so I decided to go the route of a machine-like face merged into the rock. For lighting, the head had some pulsating cracks which were tied into the body circuits. Some LED circuits made the mouth glow orange and the cylon-style eye glow yellow, but I wanted more life in the face, so I added a Larsen scanner. I had a chaser beacon that came out of the lights that are stuck on the roofs of utility vehicles. I hacked this by tracing the circuits and adding on longer wires so I could put all the LEDs in a row. I also had to change out the resistors on the board to suit the LEDs I was using (**Figure 5**).

Now all that was left to do was to figure out how to get the LEDs to create a line of light across the middle of the eye instead of the round bursts of light. For this, I took a acrylic rod and placed all the LEDs behind it. The result was the LED light was refracted out the other side as a flat beam of light. When they went off in sequence, I had a

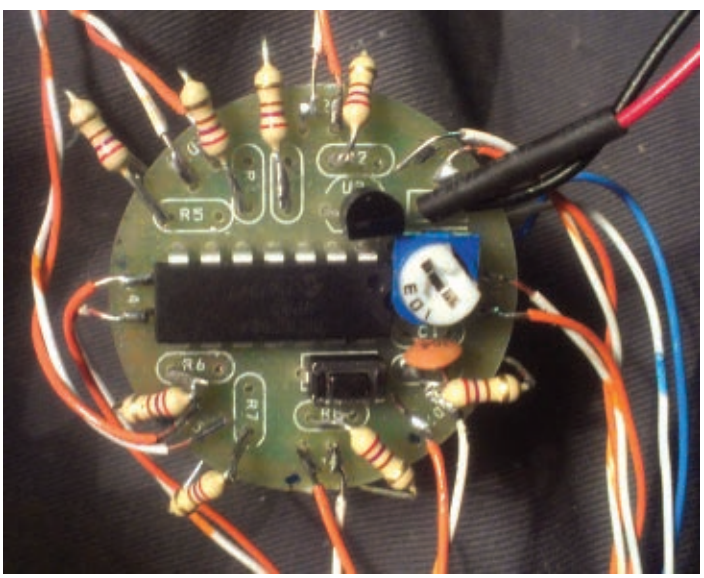


FIGURE 5. The hacked chaser beacon.

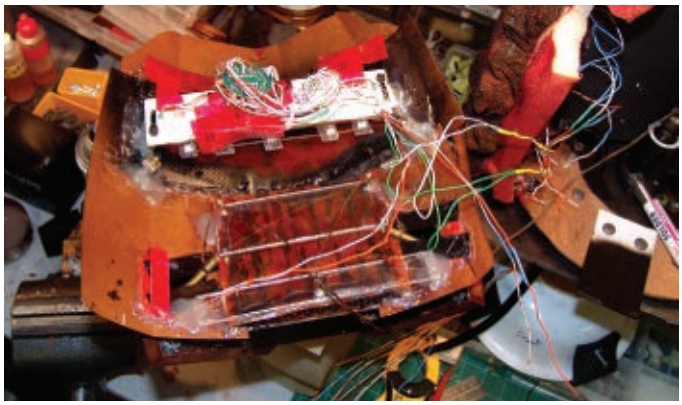


FIGURE 6. The electronics of the face, and the pulley system that activates the jaw.

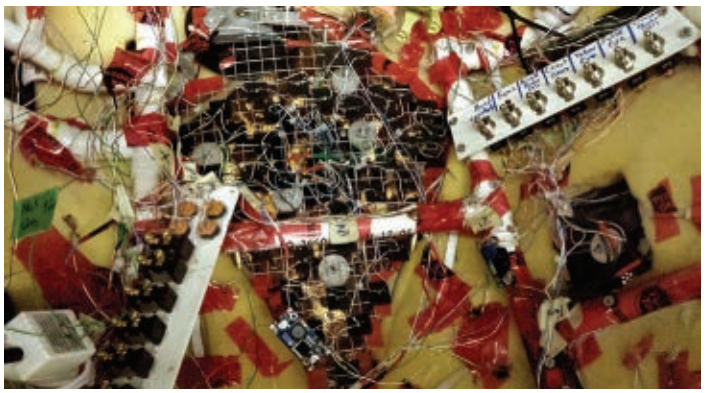


FIGURE 9. The back of the chest gears, and all the system emergency shutdown switches (before the Solarbotics upgrade).

scanner. I wasn't quite done because I also wanted to have the jaw open and close (**Figure 6**).

At the time, I was not really familiar on how servos worked, so I came up with a very rudimentary system of pulleys, lamp parts, string, and eye loops with which I was able to control the jaw via the operator's head. This was done by creating a spring-activated rod with a salad bowl that came down from the head of the Golem. When the operator pus his head in the bowl and pushes up and down, the jaw would open and close (this was later changed to a servo; refer to **Figure 7**). The head was mounted on a lazy Susan, so when the operator put his head in the bowl he could also turn the Golem's head side to side. I decided to put in some smoke effects as well, and by luck I came across a device called the Dragon Puffer which was used to detect drafts in houses by releasing smoke. I drilled a hole in the bottom of the lazy Susan, mounted a hose, and attached the Dragon Puffer at the other end so the Golem "breathed" smoke. The only problem with this was that the smoke could not make it up the tube. So, I took apart a video card heatsink, removed the fan, and tied it into the tube, then connected a 9V battery with a temporary switch.

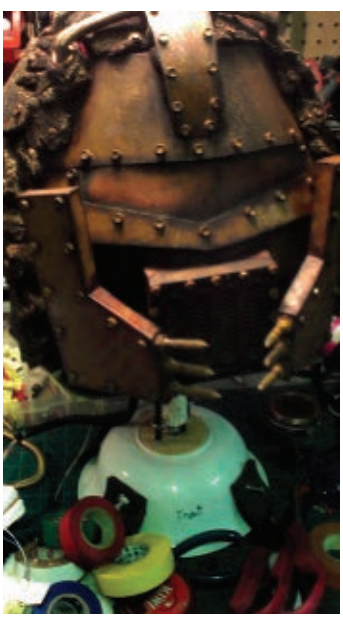


FIGURE 7. Finished head with bowl attachment.

FIGURE 8. The chest gears.

The Hand

There were not a lot of electronics here, but I created a large articulating hand using aircraft cable, PVC tubing, a cut-up tape measure, and latex tubing to create the movement of the fingers.

The Center Gear Chest Piece

Through the years, I have been taking apart hundreds of printers and saving all the gears. So, I painted a bunch of them in a brass color, aged them up, and mounted them on a piece of plexi (see **Figure 8**). To drive all the gears, I used a 12V motor I got from a local electronics surplus store and a vacuum cleaner belt. To light it up, I wanted hot spots of light behind the gears. I used chicken wire mesh as a grid and attached 50+ LEDs behind the plexi to give a warm uneven light.

In the center of the gears is a central core power cell which also lights up and pulses. To achieve this pulse, I hacked another chaser beacon and placed it behind a glass jar filled with orange scented oil beads. As each LED goes through its programmed rotation, it reflects off all the beads making very interesting patterns (**Figure 9**).

The Cockpit

Everything converges in the "cockpit" of the body. Having very little exposure to the "maker" world, I thought it was best to hide the electronics and the workings of the Golem. I couldn't have been more wrong. It turned out everyone — no matter what their interests in electronics were — wanted to see how it worked. The insanity of the inside with flashing lights, hundreds of feet of wire, and the fact that someone got in there was very fascinating.

During the wiring process, I learned to mount things so they were accessible, label things properly (which Solarbotics greatly appreciated), put proper connectors on, have a proper soldering technique, and so on. I also put in around 25 pole and

temporary switches to be able to shut down different systems in case of shorts or to conserve power. There was also a system of fans to help with the heat of the costume. Amazingly, the Golem never had a problem because everything worked as it should.

Golem 2.0

Solarbotics "sponsored" the upgrade for all of the electronics and continues to work with me as I improve my Golem. As mentioned, I come from an industrial background where black is the live wire and white is neutral. Solarbotics comes from a low voltage background where red is live and *black* is ground. Let's just say that we discovered how robust Atmel makes their microcontrollers against reverse voltage damage that melts wires together.

The Double Rainbow controllers were originally designed as Arduino-compatible/six-channel high current drivers for powering two independent RGB LED strips (R/G/B * 2), plus offered a bunch of Ground/Voltage/Signal (GVS) pins for wiring up controls. They proved to be almost perfect for the job, with handy three-wire I/O connections and screw-down terminals. Most features were wired through the cockpit control panel with beefy toggle switches, so the pilot could toggle effects for best battery life or debugging purposes.

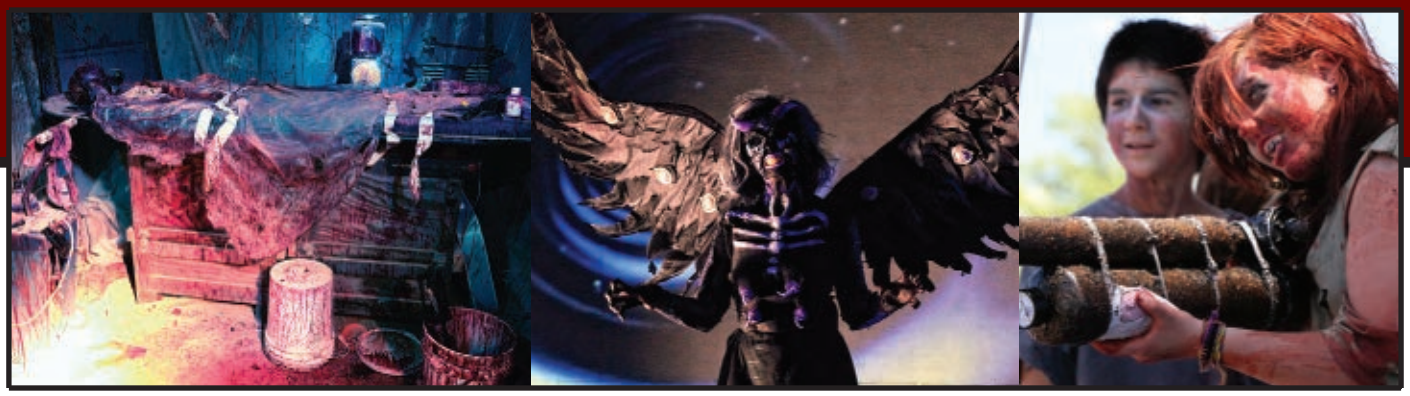
To sum this all up, at the end of the day what it takes to build one of these guys is a good inventory of discarded treasures, an understanding partner, and sheer stubborn determination to finish no matter what. Or, more simply stated as Thomas Edison once said, "To invent, you need a good imagination and a pile of junk." **NV**

Behind All Great Men

Rock Golem comes with its very own Sorceress (**Figure A**). One of the myths of the Golem is that it is brought to life by a magical person. In this instance, the Sorceress molded the Golem from the Earth and detritus around her, including rocks, machine parts, glass, and wood. This Sorceress also directly controls parts of the Golem via gesture command, activating Golem's chest gears by pressing her own chest piece. She's also in charge of his armament, controlling the spinning crystal energy weapon by raising her own arm and making a spinning motion with her fingers.

For an extended version of this write-up with more details and photos on the Rock Golem build and the Sorceress costume, be sure and go to the article link.

FIGURE A. The Sorceress (Kayna Hardman) with her crystal chest and arm bracelet, wirelessly controlling the Golem.



Behind the Boo With

By Jake Morrison

Post comments on this article at **www.nutsvolts.com/index.php?/magazine/article/september2014_Morrison.**

SCARE FOR A CURE

An Introduction to Running FX for a Charity Haunt

Figure 1.

My name is Jake Morrison, and I am the FX Director at SCARE for a CURE. Like everyone in the organization, I'm a volunteer. I say that with a giant grin as I volunteer to make gallons of blood, create pneumatic explosions, and get the drop on our customers ... with actual ceiling! My job is not to do everything by myself, but rather to coordinate with our amazingly talented volunteers to ensure that every effect is designed, built, and operated without a hitch. While I don't have a degree or deep background in engineering, I've been a hobbyist in such things all of my life. My introduction to SCARE was finding out about it at the last minute, and getting cast in the role of the "Machete Wielding Cultist." Not only was I armed with a dulled machete, but also with a pneumatic squib. Every five minutes, I came out of hiding to threaten our customer's very lives — only to be blown away by a good Samaritan with a shotgun. I died several hundred times that year, and came back for more the next.

What's different from a commercial haunt?

There are some unique challenges that one faces when designing and running the effects for a charity haunt. Although the story portion starts just over a year ahead of the haunt, nothing is concrete until the last few months before the run. So, a lot of the planning for the haunt effects involves keeping in constant communication with the story team, and creating plans and backups for what they come up with. Large-scale commercial haunts have it easy when it comes to this. They typically have a large budget and a paid team of professionals to pull off the effects.

Though we have a big team of enthusiastic volunteers (**Figure 1**), we only have a shoestring budget for effects, supplies, and well, everything! As such, we make it our goal to do more with less, and make it last longer. We are extremely successful in this; most of our effects are modular, done inexpensively, and are reused for multiple events.

Figure 1 - A well-used waterproof container.

The lightning and thunder aren't always on cue.

Another challenge we face is the weather. While central Texas is currently in a drought, we still get storms from time to time, and they are devastating when they rip through town. Even on non-stormy days, we have a nearly constant wind speed of 5-10 mph with gusts up to 20 mph. Not only do we have ad hoc effects created with a limited budget, but we have to rainproof and windproof them. The solution is rather ingenious, and was created by one of our long-time volunteers: sealable storage containers.

We just buy the cheap long rectangular plastic containers, cut a hole in one

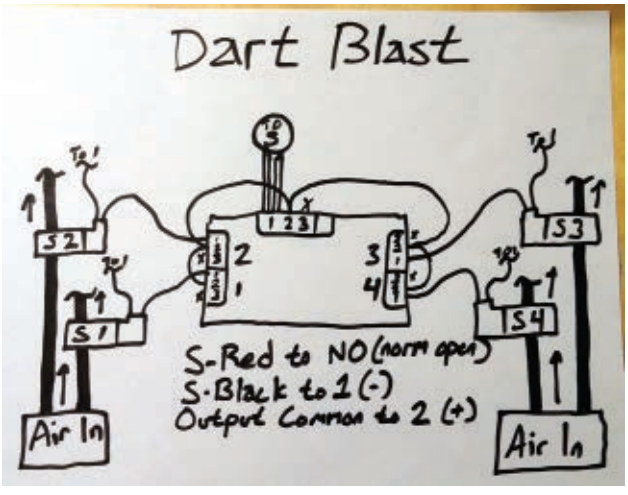


Figure 2 - Simple overview diagram to ensure the wiring works.

SCARE for a CURE — utilizing a 100% volunteer staff — designs, scripts, constructs, and presents an interactive multimedia haunted adventure in order to mentor youth and foster volunteerism and community service throughout the central Texas area. Net profits from the haunted house are donated to local cancer-related charities and/or organizations.

Born out of the ashes of the legendary haunts Britannia Manor and Haunted Trails, and raised from the infamous backyard haunt of local celebrity Jarrett Crippen (a.k.a., The Defuser — winner of Stan Lee's "Who Wants To Be A Superhero?" contest), SCARE for a CURE's talented, creative, and fiendish crew of special effects artists, set builders, audio and lighting techs, costume designers, makeup artists, and actors work year-round alongside volunteers from community organizations throughout central Texas to build the haunt bigger and better each year.

Our all-volunteer crew is passionate about Scaring and Caring. SCARE for a CURE is a 501(c)(3) non-profit organization.

end so we can run the cables in, and mount the controllers and devices on the end furthest from the hole (**Figure 2**). The lid is then sealed with duct tape and the entire assembly is mounted vertically with the hole at the bottom. A garbage bag is wrapped around the entire thing, and lo and behold, we have nearly perfect weatherproofing for less than $10. As straightforward as they are, I have yet to see any of them fail; they easily stay in place for a month and a half with no issues.

Even the best can't do it alone.

Automation is a huge boon to any haunt, and ours is no exception. It's the sad truth of any production that the tech jobs are not the most glamorous nor the most desirable, and with an all-volunteer cast, anything I can do to lessen the need for a person to sit in one place to reliably fire off an effect is worth doing. Manpower is always a challenge for a volunteer organization, and one of our primary tools for fighting that currently is the PicoBoo/BooBox controllers from **Frightprops.com**. They are dead simple in operation, which comes in handy.

An example of this was at our recent Quest Night event. There was a segment where our beleaguered and battered team of heroes (the customers, naturally) had to enter a ruined abandoned temple to search for the secret hiding place of the dread Lich King. Almost in passing, I made a joke about an Indiana Jones-esque moment where we fired poisoned darts at the customers. (Because what ruined temple is complete without poisoned darts?) The legality of actually darting our customers was called into question quickly, so I set about devising a way to fake it with automation.

The simplest way to accomplish the effect was a series of directed air blasts. One of the PicoBoo controllers has the capability to control four outputs, making it perfect for the effect. I grabbed four solenoids from our supply bin and set to work. The solenoids are pretty standard; they are a five-port model, with two outputs and two exhausts. Perhaps they are a bit overkill for this particular effect, but they were available which is what makes them perfect.

Like a lot of our last-minute effects, this particular effect didn't have an elaborate planning session. The idea came up in a meeting, it was agreed it would be fun, and the next day I was on site building it. Even so, I made a quick sketch on a scrap bit of paper to make sure the logic was sound (**Figure 3**).

An offshoot of our master air line would enter a four-way manifold to distribute the air to the solenoids. Pneumatic tubing was run from the solenoids, poked through four different holes in the wall, and then taped into place.

The electronics side was easy, as well. An infrared break-beam would provide the trigger signal to the controller. Each of the four solenoids was wired to a separate output on the controller (**Figure 4**) and a quasi-random pattern was programmed in after a short delay. Once the beam was broken, a five second timer began.

Like any good tech, I decided to test this effect by calling the director over to "check something out." His startled reaction was an indication that the effect was good, and reports from our customers agreed. The manifold, controller, and solenoids were packed in one of our waterproof boxes, and it was screwed into the off-stage side of the wall. After it was placed, it didn't need to be messed with or altered until it was time to take down the haunt.

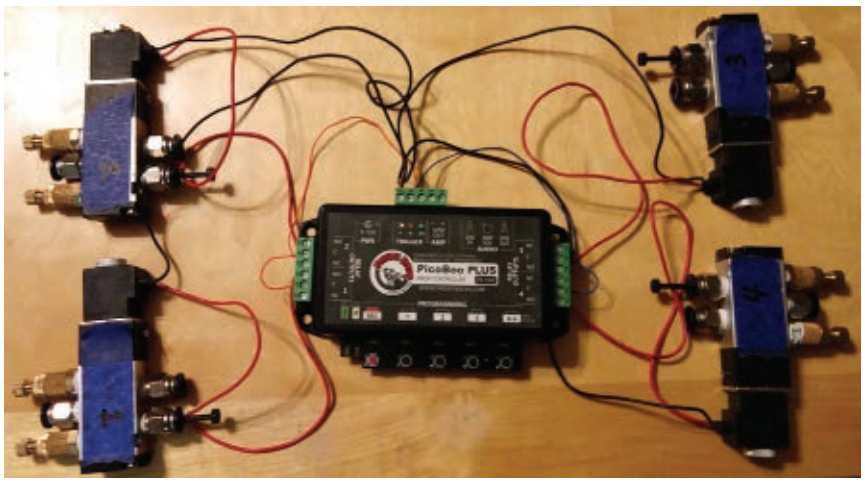


Figure 3 - Completed wiring setup for four solenoids.

Making sure the customers have a blast.

Quite possibly our most popular effect — both with customers and crew — is our gore cannons. These effects are responsible for the mass-drenching of thousands of people a year, and also the creation and consumption of hundreds of gallons of fake blood. This effect is usually placed in an area of particular significance to the story, be it the demise of the Big Bad at the end of the haunt, or a troubled toilet connected

Scare for a cure is located at:

J. Lorraine Ghost Town in Manor, TX
(Just a few miles east of Austin)
14219 Littig Road
Manor, TX 78653

Days and hours of operation for 2014:
Friday, October 3rd: Sneak Peek until 1:30 am
Saturday, October 4th: Opening Night until 1:30 am
Thursday, October 9th: Run Night until 12:30 am
Friday, October 10th: Run Night until 1:30 am
Saturday, October 11th: Run Night until 1:30 am
Thursday, October 16th: Run Night until 12:30 am
Friday, October 17th: Run Night until 1:30 am
Saturday, October 18th: Run Night until 1:30 am
Thursday, October 23rd: Run Night until 12:30 am
Friday, October 24th: Run Night until 1:30 am
Saturday, October 25th: Run Night until 1:30 am
Thursday, October 30th: Run Night until 12:30 am
Friday, October 31st: Run Night until 1:30 am

Figure 4a - A blast of water from a gore cannon.

Figure 4b - Customers experience a gore cannon water drenching first hand

to a problematic plumbing system. (Gore is not always blood! Sometimes it's just offal.) It operates just as it sounds: Once the effect is activated, a sizeable quantity of liquid is pneumatically flung at our customers (**Figure 5**).

The construction of a gore cannon is pretty simple. The stem of an old propane tank is removed and a fill/dump assembly is attached. This assembly consists of the male connector to an air hose quick connect to fill, and a dump valve to send the air to the effect through an inch wide camlock quick connector (**Figure 6**). This sends the air directly to the launcher assembly which is where the payload is held.

In practice, all the launchers are unique. In general, the current incarnation looks like an upside down T. The shape is made using PVC pipe with a diameter of 1-1/2 inches. At one end of the horizontal section is where the air hose from the pressure cylinder connects; at the other end is a 45 degree angled elbow of PVC (**Figure 7**).

The upright section is pretty close to the air hose end and has a standard gate valve. This valve is opened to dump in the gore and closed to fire the cannon. The lengths and angles of various pieces changes to alter the spread, distance, and height of the effect.

What makes this effect challenging is the power source. The pressure cylinders were created by a predecessor of mine, and he used 12 VDC dump valves to control the effect. While these are fantastic, sturdy, and reliable devices, they require a voltage and current change before they can be used. Like most of our problems, there is an easy and thrifty solution to this too.

We start off with a two-gang plastic outlet box, a standard outlet, a light switch, and a 12 VDC AC adapter. The outlet and switch are wired together in such a way that the outlet can be turned on and off with the switch (**Figure 8**). The 12 VDC AC adapter is then hardwired to the outlet, and the 12 VDC solenoid leads are wired into a standard cheap extension cord. You then plug the power assembly to any 110V AC power source, plug the cannon into the hot outlet, and a simple flick of the switch fires the cannon.

Of course, any such kludged together cobbling of electronics is prone to failure. The simplicity of the wiring is such that it is easy and quick to open it up and find the loose wire or bad connection. The parts and pieces are all readily available and inexpensive, which makes replacement a cinch. The effect also cannot be beat; we have return customers who come dressed in clean, brand new white clothing just so they can have pictures of the crimson transformation they undergo by the end of the haunt!

Figure 5 - The pressure cylinder of a gore cannon.

It's never too late to start planning for the future.

What's in the future for the effects of SCARE? On the distant

Figure 6 - The launcher assembly for a gore cannon.

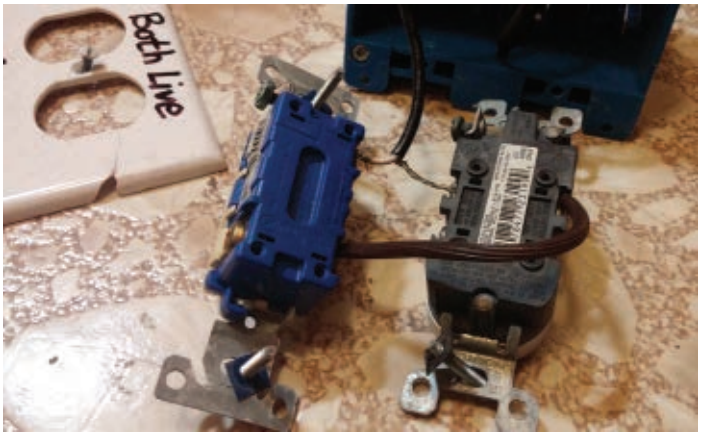


Figure 7 - The wiring needed to make a switch activated outlet.

horizon, there is more automation. While I do adore the ease of use of the PicoBoo system, I'd like to start moving the haunt to custom Arduino boards. This will give us greater flexibility from year to year. As a bonus, at that point it will be relatively easy to create a centralized command and control system, allowing us to control the effects from a single position.

The gore cannon launchers are going to be simplified as much as possible, and then constructed out of stainless steel piping. A special focus will be set on crafting and bringing to life flame effects reliably.

The main goal going forward is — as always — do more with less and make it last longer.

Directly in our immediate future is our haunt in October. The theme is "Return to Zombie Wasteland" — a high powered sequel to one of our most successful years. As I write this article, it is mid-July, and we are already deep in planning the effects this year. It's far too early to go into detail, but the effects will range from an electrified sparking fence, to a quite literal volcano of gore, and a top-secret effect that will be the single most complicated contraption SCARE has ever attempted.

It's going to be an amazing year for SCARE, and things will just keep getting better. If you find yourself near Austin, TX this October, or truly, in any given October, come check us out. I promise you'll have a blast. **NV**


IF "EXPECT THE UNEXPECTED" WEREN'T SO EXPECTED, WE'D SAY THAT'S EXACTLY WHAT TO EXPECT.
The 2015 International CES® Four days of business, innovation and exactly what you didn't expect. Register at CESweb.org.
2015 International CES®
THE GLOBAL STAGE FOR INNOVATION
PRODUCED BY CEA
JAN. 6-9, 2015
LAS VEGAS, NEVADA
CESWEB.ORG
#CES2015

It's almost Halloween — the favorite time of year for electronic hobbyists to show off their skills! If you're like me, anything worth doing is worth overdoing. So, this is the perfect time to complete your decorations with a singing animation of Halloween songs!

Don't look at me that way. There is too such a thing as Halloween songs! In fact, I made a playlist of Halloween songs available to stream for free from Xbox Music (**http://bit.ly/1ly7eCG**). Granted, most people wouldn't go door to door caroling Halloween songs. Personally, I find it less awkward opening the door to people in masks threatening harm if they don't receive processed sugar treats than a group performing an impromptu concert. Do I applaud? Invite them in for figgie pudding? Maybe that's just me.

PumpkinFX

By Graham Best

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Best**.

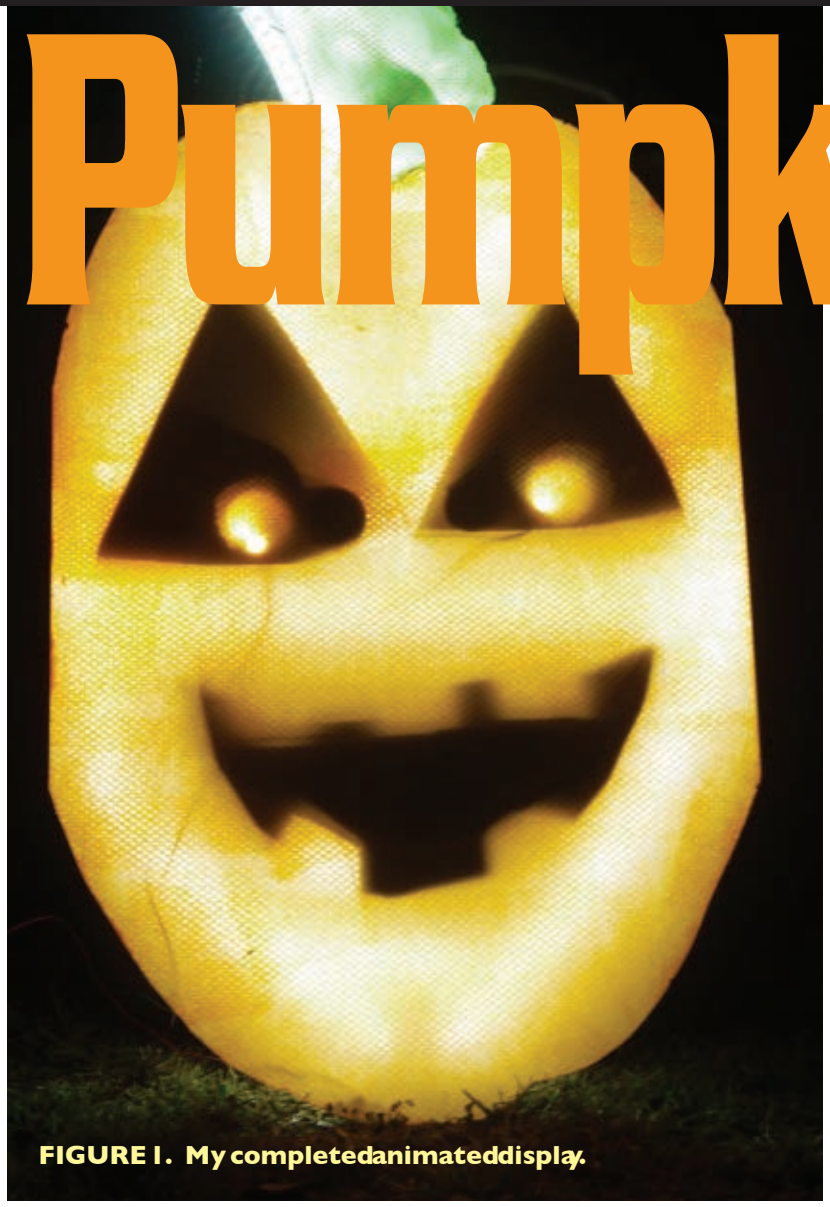


FIGURE 1. My completedanimateddisplay.

Tools You'll Need

- Jigsaw with wood blade
- Drill with drill bits and screwdriver
- Sandpaper
- Clamps
- Plastic cutting blade
- Soldering iron
- Tweezers
- 10X Loupe
- Pencil
- Carbon paper for tracing designs (optional)
- String (optional)
- Cans of your favorite food (Yes, really. Optional, but I'll explain later.)

You'll also need a 12V LED strip and 12V LED power supply. These can be substituted if the display size changes.

This Halloween, you can treat your tricksters to both dessert and a show. This project is easy to solder together and uses common tools to assemble. Best of all, the animations for the Halloween songs can be downloaded for free!

Some of you clever readers are probably thinking that this could be repurposed for Christmas. You would be right! In fact, I designed the electronics to be reused for Halloween and Christmas by swapping out the face front for each holiday. It means less work to leave the decorations up without the homeowner's association complaining that your decorations are out of season. That means more time for Christmas shopping, making cookies, or caroling, if that's what you're in to.

There are two parts to this project: lights and electronics. You get to use both your creativity and your logic, so it's a right brain/left brain kind of deal.

Lights

The lights are the creative part of this project. I made a pumpkin face, but you can use your imagination to build whatever scary face suits you: monster, ghost, vampire, or politician.

The face has three animated parts: two eyes and one mouth (unless your imagination takes you in a different direction). Each of these animated parts will have six segments that are lit up with LED strips. "Why does the mouth need six segments if I only need open and closed?" you might be asking. The answer has to do with Preston Blair.

Animating a Mouth

Preston Blair was an animator who worked on some of Walt Disney's early animated movies. He later worked at MGM and Hanna-Barbera. Blair figured out that of all the sounds an English speaker can make, there are only 10 different mouth shapes that are needed in order to produce them. These mouth shapes mimic natural lip movements and make the singing animation look far more realistic.

When you're doing a lighting animation, however, you want to get as many of those mouth shapes to appear correctly in the least amount of lights. One approach is to use a separate string of LED lights for each mouth shape, but that's inefficient. The clever part of this project is that I figured out how to get all 10 of Blair's mouth shapes with only six light segments. This is done by adding or subtracting various shapes in order to make the mouth look natural (**Figure 2**). Neat, huh? (Yes, I patented this approach. Feel free to use this design for your own personal projects, but you'll need to contact me if you want to sell a commercial product based on this.)

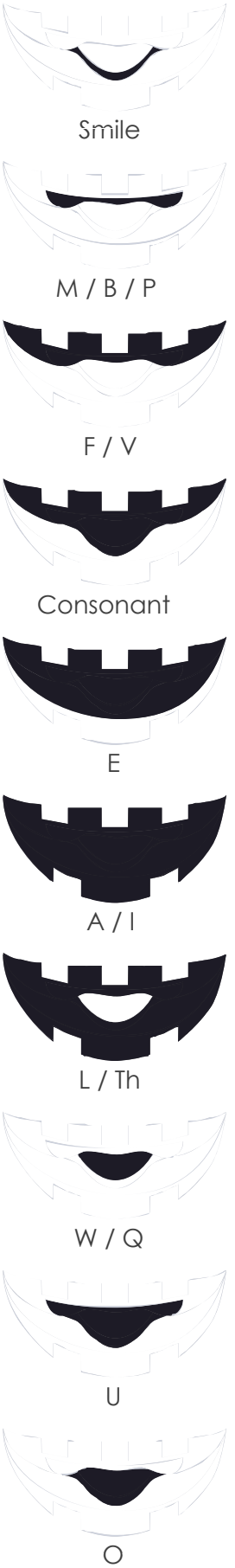


FIGURE 2. Mouthshapes.

Planning for the Animated Display

You could put all of the LED strips on one layer of plywood, and I wouldn't blame you if you did. My approach is to do a little more work to save a lot more time later. The advantage of doing this is reuse of the electronics and half of the construction. The reuse approach will divide the animated display into two major elements: the face front, and the light box to hold the LED strips that create the animation. The light box will be reused, and the face front can be swapped out (**Figure 3**).

It may be easier to understand this approach if you view the face front and light box from the side (**Figure 4**). The lights extend past the height of the light box and touch the diffuser directly.

I have a small yard, so the size of the animated display I built is about 2′ x 3′. If you have a bigger yard, you're welcome to scale up the size. The swappable face front has two parts: a light diffuser and MDF backing. The light diffuser is the same acrylic panel that is typically installed in

FIGURE 3. Finished animated display parts.

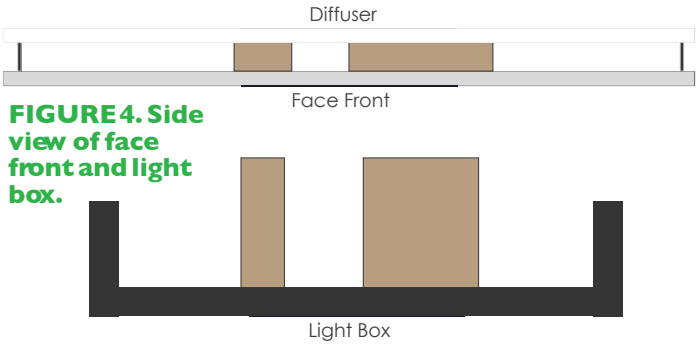


FIGURE 4. Side view of face front and light box.

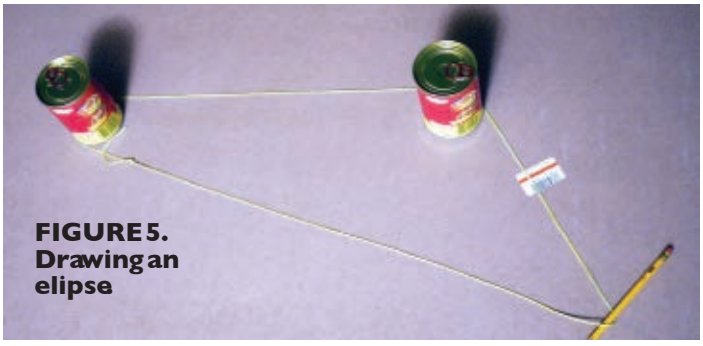


FIGURE 5. Drawing an elipse

office buildings to diffuse fluorescent lights. They're readily available at stores like Home Depot in 2′ x 4′ panels (which is why my display is 2′ x 3′).

If you want a larger display, you'll need to use either more than one diffuser or a frosted piece of plastic. Craft stores sell spray paints that will frost most anything. Files for the eye and mouth segments are available at the article link to use as a reference pattern.

Drawing the Face

Referring to **Figure 5**, start the face by drawing an ellipse on the MDF backing. How do you do this on a large surface area? Math! In order to draw a circle, you'd need a pencil, a piece of string, and an anchor. Put the anchor where you want the center or focus of the circle, tie the string between the anchor and the pencil, then trace the circle by stretching the string as far as it will go. When the pencil goes around a full 360 degrees, you'll have a perfect circle. So, how do you do this with an ellipse?

If you remember your math (if you don't, check Wikipedia), an ellipse has two focal points where a circle only has one. You'll need two anchors to draw an ellipse; food cans work fine. Use the string to tie a loop and place it loosely around both anchors. If you stretch the string with the pencil and go around 360 degrees, you'll have a perfect ellipse. Move the anchors to change the shape of the ellipse, and increase the length of the string to increase the size.

If you want a more natural face, sketch the opening for the eyes at about the center of your display. Make the opening of the eyes large so you have enough room to incorporate all of the segments for the eye animations. The mouth will be centered between the eyes and edge of your display. Again, make the mouth large enough to be open with an "ah" shape. You can also download a template that I used to make the face from the article link or **pumpkinfx.com**. Print it out, then trace the design onto the MDF using carbon tracing paper.

RESOURCES

Video of Pumpkin FX in action
http://youtu.be/O8uP-HvdyBY?list=PLspAjBMFIH06UIKM6welw174GhSIgbR94

Halloween Playlist on Xbox Music
http://bit.ly/1ly7eCG

Preston Blair Mouth Shapes
www.garycmartin.com/mouth_shapes.html

Falcon Christmas
http://falconchristmas.com

SDFormatter utility by the SD Association
www.sdcard.org/downloads/formatter_4/

Falcon Pi Player Tutorials by Alan Dahl
http://falconchristmas.com/wiki/index.php/Tutorials:_FPP_Setup

"How to protect circuits from reversed voltage polarity!" by Afrotechmods
http://youtu.be/IrB-FPcv1Dc

"Surface Mount Soldering 101" by CuriousInventor
http://youtu.be/3NN7UGWYmBY

Building the Face Front

Use a drill to make pilot holes in the eyes and mouth on the MDF panel, then use a jigsaw to cut out the shape of your face. Use sandpaper to smooth out any rough spots. Cut out the shape for the diffuser next. The outline of the diffuser should match the MDF panel you just cut, and you can use this panel as a template. Clamp the diffuser and MDF panel together while you make the cuts. Go slowly in order to prevent chipping on the diffuser. Finish the diffuser by painting on the smooth side with opaque glass paint which is available at a craft store. You may need more than one coat as painting smooth surfaces is a bit of a challenge.

Building the Light Box

For my light box, I'm using a Sterilite 67 quart underbed box (UPC 073149189585). This works well for a small display because all of the electronics are contained in one box. For a bigger display, you can split the light box into three separate units. I removed the wheels on my plastic box and painted the outside with black spray paint.

The segments for the animated display need to be distinct from each other. This means that the light from one segment shouldn't bleed into another segment. In order to separate the lights, we'll need to use two of the most magical items used for crafting.

The first is cardboard. It's cheap, sturdy, lightweight, readily available, easy to cut, forgiving if you make a mistake, and accepts paint extremely well. The only

FIGURE 8. Cardboard mouth segments.

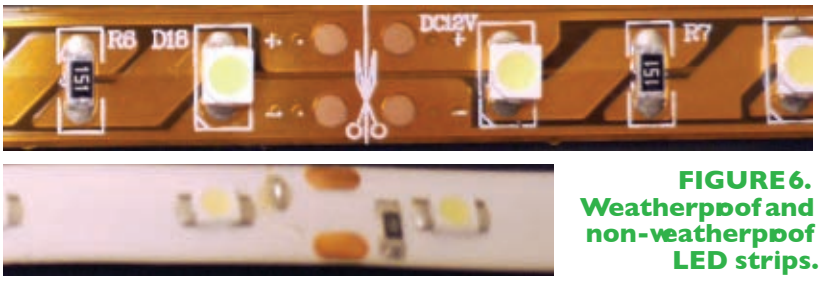


FIGURE 6. Weatherproof and non-weatherproof LED strips.

substance with more magic is duct tape. Its magical properties go far beyond what mere mortal words can describe. There is nothing you can't accomplish with duct tape. It is the holy relic of the crafting world.

FIGURE 7. MDF pieces for mouth segments.

Building the Eye Segments

Place the MDF panel with the eyes and mouth cut on top of the light box. It's time to create the segments in the eye. Don't tape the cardboard down until you check its position and add the LED strips. Use three cardboard tubes — like the kind found in paper towels — to mimic movement of the pupil. This is going to allow the eye to look left, right, or straight ahead. Use a cardboard tube that's larger in diameter in the middle. This is going to make the face look surprised. Finally, add a cardboard division above to frame the pupils which will make the eyes look angry.

An optional part to make the animated display brighter is to use a sheet of reflective Mylar and tape it down to all of the surfaces you want to illuminate. Mylar is the stuff that metallic balloons that are caught in power lines are made of. It's also sold as "space blankets." You can try to find Mylar locally at an Army surplus store or strangely enough at a hydroponic store. (Why people would ever want to send a plant into space wrapped in Mylar is a topic for another article.) Aluminum foil could be used as a substitute, but it's not as reflective. Another alternative is reflective spray paint.

The LED strips that you want to use for your animated display are the 12 volt non-weatherproof cuttable strips (**Figure 6**). There are waterproof LED strips that are cuttable, and at first you'd think that these are the type of strips you'd want to use since this display will be outdoors. However, the weatherproof version of the strips cannot be soldered again once cut as they have a rubber coating on top of the solder points. The non-weatherproof strips have these solder points exposed, so you can get more segments out of the strip. Cut the strips long enough to line the segments, solder wires long enough to reach the LED controller, then tape down the segments.

Building the Mouth Segments

The mouth segments are a bit more complex than the eye segments, but it's not difficult once you understand the assembly. From your leftover MDF, cut out two shapes that match the two innermost pieces of the mouth (**Figure 7**). Now, line the MDF shapes with cardboard as shown. Tape the cardboard to the MDF cutouts or use a hot glue gun if you don't mind the occasional burned finger. There should be three segments made from the two pieces of MDF. The smaller shape will be the tongue. This shape will sit on top of the larger one.

The larger shape has two segments. The upper segment is for the lips that are used to make the M/B/P sounds. The lower segment is for the lips in a smile position. Leave the lower piece of cardboard long for the larger shape as it will be used to create the upper part of the middle mouth. Add one more piece of cardboard for the bottom part of the middle mouth. Add Mylar (if using) and the LED strips like you did with the eyes (**Figure 8**).

Finishing the Face Front

To finish the face front, cover the front of the MDF panel with Mylar (again, if using) and cut out holes for the eyes and mouth. I'm using spray adhesive to attach the Mylar to the MDF. Use some more LED strips to line the MDF panel so the entire face will be illuminated. Next, create some standoffs between the MDF panel and the diffuser. The diffuser works better when there's some distance between it and the lights it's diffusing. I found that a distance of four inches works well to remove any 'hot spots' created by the LED strip.

An optional part is to use some plastic — like a tarp or

FIGURE 9. Raspbery Pi.

a plastic bag — to tape up the sides of the face front to reduce exposure to the elements. I live in southern California where it rains very little; we don't really have 'weather.' Finally, attach the face front to the light box with something like eye hooks and bungee cords. Or, if you're short on time, duct tape will work its magic.

Electronics

Setting Up the Raspberry Pi

In the past, it used to take a desktop computer and an expensive controller in order to run holiday light shows. Electronics have gotten much cheaper and more powerful since the first animated light shows, so it's easier to get started.

Our animated display will be controlled by a Raspberry Pi (RaspPi for short). Even though it's only $35, it's a full Linux computer (**Figure 9**). There are several different versions of the RaspPi: A, B, and B+. The version that we need to use here is version B, as it has a built-in Ethernet port and more RAM. The B+ version should theorically work as well, but at the time of this writing the B+ had been announced and not released, so I was not able to test it.

The software that will be installed on the RaspPi is a wonderful software package called Falcon Pi Player (FPP), programmed by the talented Chris Pinkham. The software is available from **http://falconchristmas.com**. In order to install FPP, you'll need a 4 GB SD card (or microSD if you're using the B+ version) and a USB drive. The SD card will have the operating system and Falcon Pi Player software. The USB drive will be used to store the animations and music. The RaspPi is fairly particular in how the SD card is formatted for its operating system. The SD card needs to have the format size adjustment off. This is something that Windows 8.1 has some difficulty doing. Fortunately, there's a utility available by the SD Association called SDFormatter. The utility was specifically created for formatting external storage like SD cards. It's available from **www.sdcard.org/downloads/formatter_4**. Unfortunately, I found this utility is also particular about

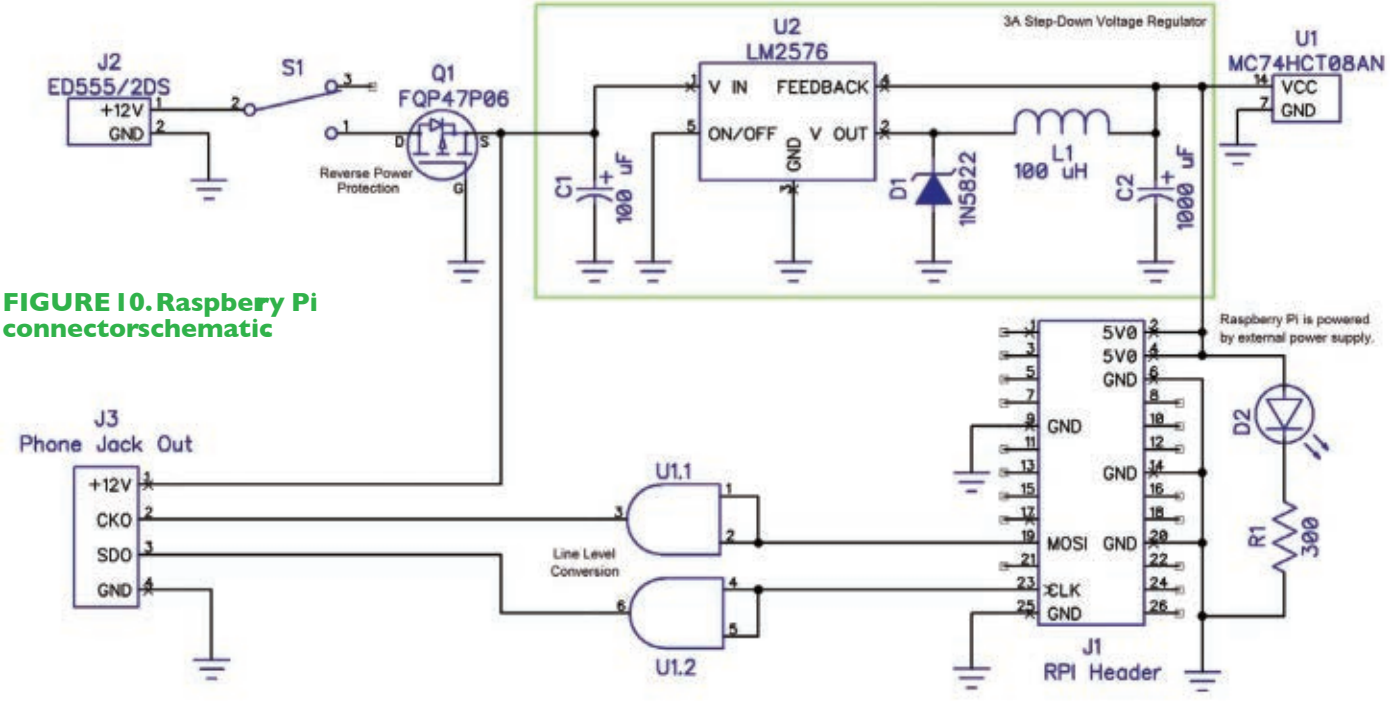


FIGURE 10. Raspbery Pi connectorschematic

the SD card readers that it works with. It doesn't work with the SD drive in my laptop, but it will work with an external SD drive.

I haven't used a Mac to format an SD card for a RaspPi, but based on the research I've done it doesn't seem like there are the same problems that Windows has.

Once you have the SD card formatted, you need to copy the Falcon Pi Player software over to the card. This can be done with a simple drag-and-drop from the .ZIP file you downloaded from Falcon Christmas over to the SD card.

The first time you set up the RaspPi, you need to plug in the SD card, the USB drive, the network cable, and a speaker. There won't be any animations or songs on the USB drive at this point. The directories will be created when the Falcon Pi Player is first turned on.

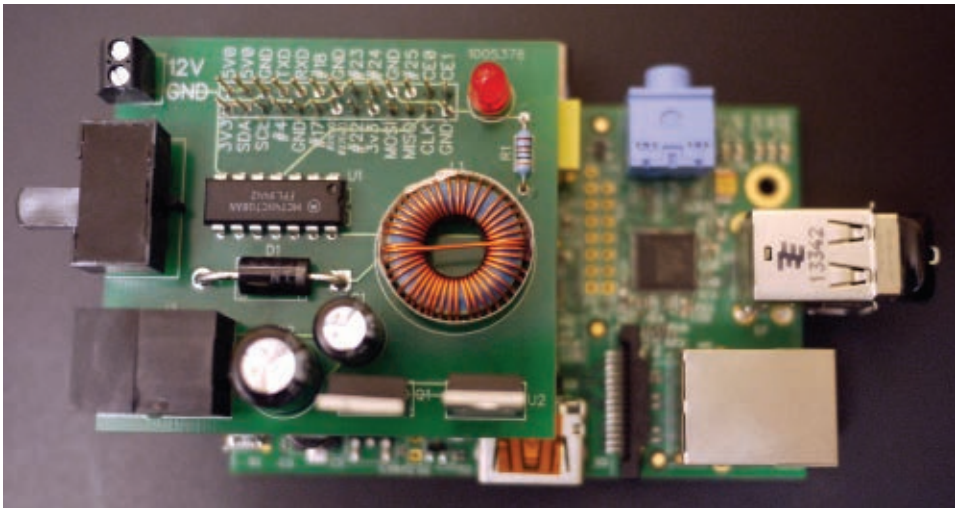


FIGURE 11. FinishedRaspbery Pi connectorPCB.

Once you have everything connected, you can connect 5V to the USB port to start up the software. If the red PWR LED on the RaspPi is the only LED that's on, you haven't pushed in the SD card far enough. It will take about eight minutes for the software to install itself the first time.

Once it's done, the IP address for the local Falcon Pi Player website will be announced over the speaker. The default IP address is 192.168.0.10. You can connect to the RaspPi via a web browser to check if it's working. Alan Dahl made a pretty good video tutorial page on how to set up the Falcon Pi Player if you need more help. Those tutorials are available at **http://falconchristmas.com/wiki/index.php/Tutorials:_FPP_Setup**.

Building the Raspberry Pi Connector

There are two custom printed circuit board (PCB) types for the animated display: the RaspPi connector and the LED controller. Each face will have three LED controllers: one for each eye and one for the mouth. So, there's a total of four circuit boards. The parts and PCBs can be ordered from the *Nuts & Volts* webstore.

The RaspPi connector attachs directly to the RaspPi via a 26-pin header (**Figure 10**). This board takes power from a 12V source. You'll need a 12V power supply that is used to power the LED strips. I added reverse circuit protection with the Q1.

There's a clever video on YouTube that explains exactly how this P channel MOSFET protects the circuit without a voltage drain that a diode would take. Watch it at **http://youtu.be/IrB-FPcv1Dc**. The RaspPi uses 5V, so the 12V input needs to be converted to a voltage that the RaspPi can use. The parts in the green box on the schematic do this. I tried to use a simple LM7805 voltage regulator, and it got uncomfortably hot. The LM2576 is a much better choice as it doesn't get hot at all.

The AND gate in the 7408 doesn't look like it's doing much. However, the output for the RaspPi is 3.3 volts, and we need to have five volts to guarantee the correct high voltage. The 7408 provides the line level conversion.

Lastly, there's a standard RJ11 phone jack on the circuit board to connect to the LED controller circuit boards. Since the boards can't use the telephone to talk to each other, I used the RJ11 connector because it's still pretty easy to find standard telephone cable even in the age of the smartphone. The four pins used are 12V, ground, a data clock, and a serial interconnect bus (SDO).

When assembled, the RaspPi connector looks like what you see in **Figure 11** You'll notice there are leads that are standing from the GPIO header. Don't cut those off; they're used to stack any additional boards to connect to the RaspPi.

Building the Controller

The LED controller takes the signals from the RaspPi and turns on the LED strips; see **Figure 12**. The heart of this controller is the WS2801 from WorldSemi. The WS2801 is very powerful despite its small size. Each IC has its own address based on its position in the series. Not only can each light be turned on individually with a simple two-wire interface, you can also fade lights with 256 degrees of intensity. The WS2801 chip is commonly used to change the color of a single RGB LED, but it's also powerful enough to switch a series of LEDs. The IC can be used anywhere from LED decorative lighting to LCD TV back lighting. This IC sounds too good to be true, right?

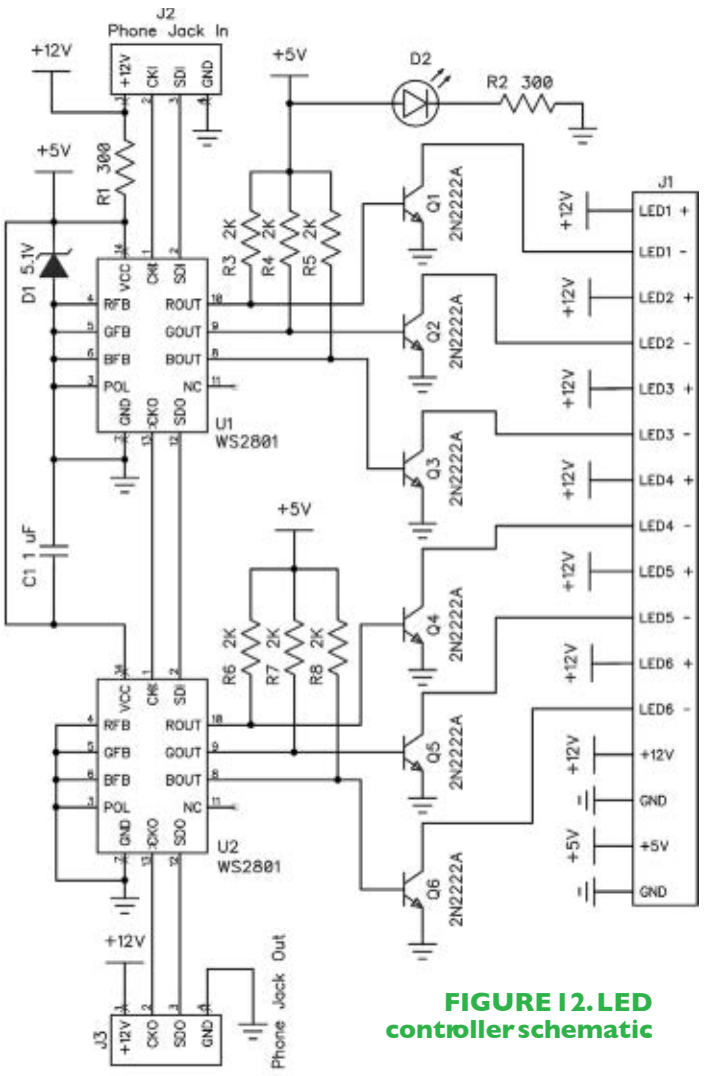


FIGURE 12. LED controller schematic

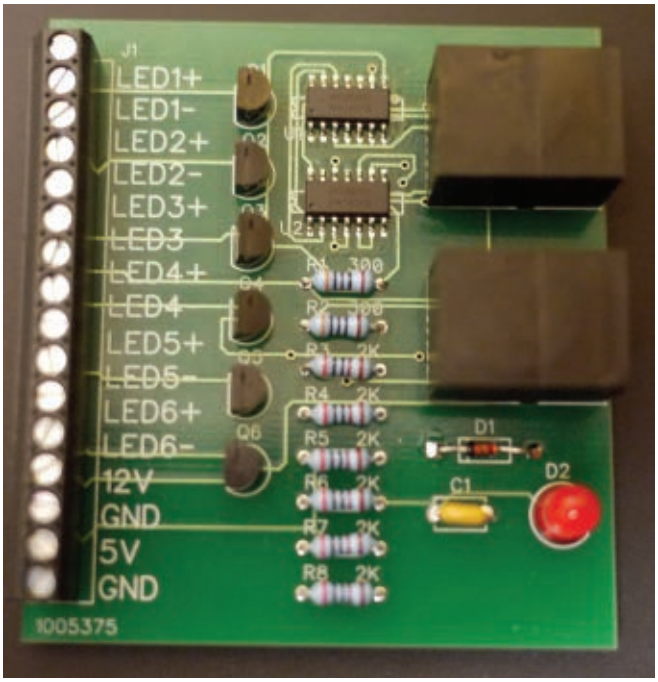


FIGURE 13. FinishedLED controller PCB.

Well ... There's one tiny downside. When I say tiny, I mean that the IC is only available as a surface-mount device. WorldSemi used to offer the WS2801 IC in a through-hole DIP package, but stopped a few years back. Why they did this, I have no idea. It seems like the perfect hobbyist LED controller, except for this one tiny problem.

Soldering the IC isn't actually horrible, to be honest. I've soldered a lot smaller ICs. Soldering SMD components isn't much harder than through-hole components. It's just a bit different. You'll need a few other tools in addition to the ones you already have — a smaller tip, a smaller diameter of solder, a bottle of flux, and a magnifying lens (10x Loupe) — in order to check if you soldered everything correctly. There's a good nine minute video on YouTube that shows how to solder SMD components at **http://youtu.be/3NN7UGWYmBY**.

Think of it this way. You probably already wished that you knew how to solder SMD components but didn't have a good excuse to do so. Now's your chance to learn a new skill! A lot of powerful ICs are available in an SMD package only, so this new found skill will give you an even greater list of components to choose from. (Do I sound like a politician yet? Okay, I'll stop.)

The circuit for the LED controller is fairly straightforward: 12V is converted to 5V with a simple zener diode. The WS2801 doesn't need as much current as the RaspPi. Power for the LED strip is turned on or off with an NPN transistor. It's easier to switch off ground than the +12V needed to power the LED strip. The LED strips are connected to a terminal block that is labeled for

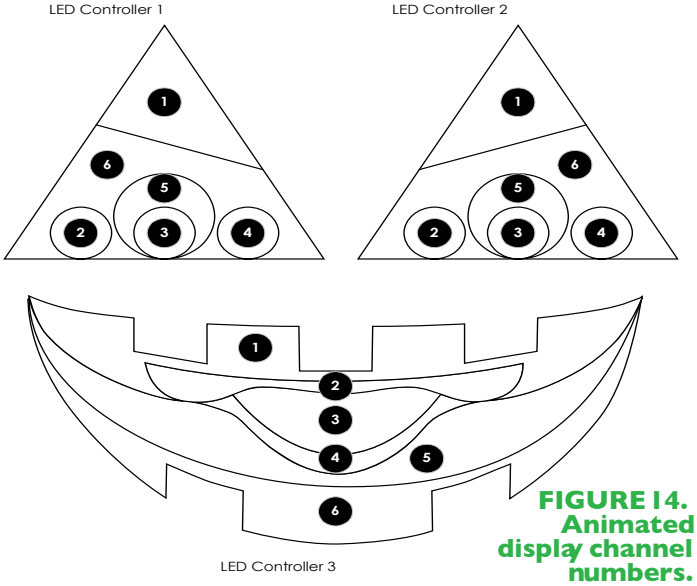


FIGURE 14. Animated display channel numbers.

RaspPi Connector Board

Qty	Description	PCB ID / Part Source
1	Stacking Header	J1 www.adafruit.com/products/1112
1	Power Connector ED555/2DS	J2 www.digikey.com/product-search/en?lang=en&site=us&keywords=ED555%2F2DS&x=0&y=0
1	Phone Jack A-2004-0-4-LP-N-R	J3 www.digikey.com/product-search/en?lang=en&site=us&keywords=AE10382-ND&x=0&y=0
1	Power Switch L102021ML04Q	S1 www.digikey.com/product-search/en?vendor=0&keywords=CKC5102-ND
1	Line Level Converter SN74HC86N	U1 www.digikey.com/product-detail/en/SN74HC86N/296-8375-5-ND/376842
1	Voltage Regulator LM2576T-005G	U2 www.digikey.com/product-search/en?lang=en&site=us&keywords=LM2576T-005G&x=0&y=0
1	100 µF 50V Cap ESY107M050AG3AA	C1 www.digikey.com/product-search/en?KeyWords=ESY107M050AG3AA&WT.z_header=link
1	40V 3A Diode 1N5822-TP	D1 www.digikey.com/product-detail/en/1N5822-TP/1N5822-TPMSCT-ND/1793294
1	100 µH Inductor 2112-H-RC	L1 www.digikey.com/product-search/en?lang=en&site=us&keywords=2112-H-RC&x=0&y=0
1	1,000 µF 10V Cap ESY108M010AH2EA	C2 www.digikey.com/product-detail/en/ESY108M010AH2EA/399-6662-1-ND/3082794
1	Red LED WP7113ID	D2 www.digikey.com/product-detail/en/WP7113ID/754-1264-ND/1747663
1	300 ohm Resistor CFM14JT300R	R1 www.digikey.com/product-detail/en/CFM14JT300R/S300QCT-ND/2617732

LED Controller Board

Qty	Description	PCB ID / Part Source
1	5.1V 500 mw Zener 1N5231BTR	D1 www.digikey.com/product-detail/en/1N5231BTR/1N5231BFSCT-ND/1532765
1	Red LED WP7113ID	D2 www.digikey.com/product-detail/en/WP7113ID/754-1264-ND/1747663
2	Phone Jack A-2004-0-4-LP-N-R	J1-2 www.digikey.com/product-search/en?lang=en&site=us&keywords=AE10382-ND&x=0&y=0
1	ED555/16DS 3.5 mm 16-pos Block	J3 www.digikey.com/product-search/en?lang=en&site=us&keywords=ED1526-ND&x=0&y=0
1	1 µF 50µF Cap K105Z20Y5VF5TH5	C1 www.digikey.com/product-detail/en/K105Z20Y5VF5TH5/BC1168CT-ND/286790
2	300 ohm Resistor CFM14JT300R	R1-2 www.digikey.com/product-detail/en/CFM14JT300R/S300QCT-ND/2617732
6	2K resistor RNMF14FTC2K00	R3-8 www.digikey.com/product-detail/en/RNMF14FTC2K00/S2KCACT-ND/2617814
2	PWM LED Driver WS2801SOP	U1-2 www.futurlec.com/Others/WS2801.shtml
6	40V NPN Transistor P2N2222AG	Q1-6 www.digikey.com/product-detail/en/P2N2222AG/P2N2222AGOS-ND/920244

each strip. When the PCB is assembled, it looks like what you see in **Figure 13**.

Putting It Together

Wire the LED strips according to **Figure 14**. Run the telephone wire in the sequence shown in **Figure 15**. Remove the USB drive from the RaspPi and insert it into your desktop computer. Download the animation files you're interested in, then copy those animation files into the sequences directory. You'll need to provide the music files yourself. If you don't have the music already in MP3 format, you'll need to purchase the tracks and download them from Amazon. Copy the music tracks to the music directory on the USB drive. Return the USB drive back to the RaspPi.

Last, you'll want to connect the 12V power supply to power the LED strips and electronics. You'll know if everything has power because the power LEDs will be lit on the circuit boards. If not, go back and check your connections. If you've set up this project, I'd love to see pictures of your display! You can connect to **pumpkinfx.com** for more information and tips.

Happy Haunting! **NV**

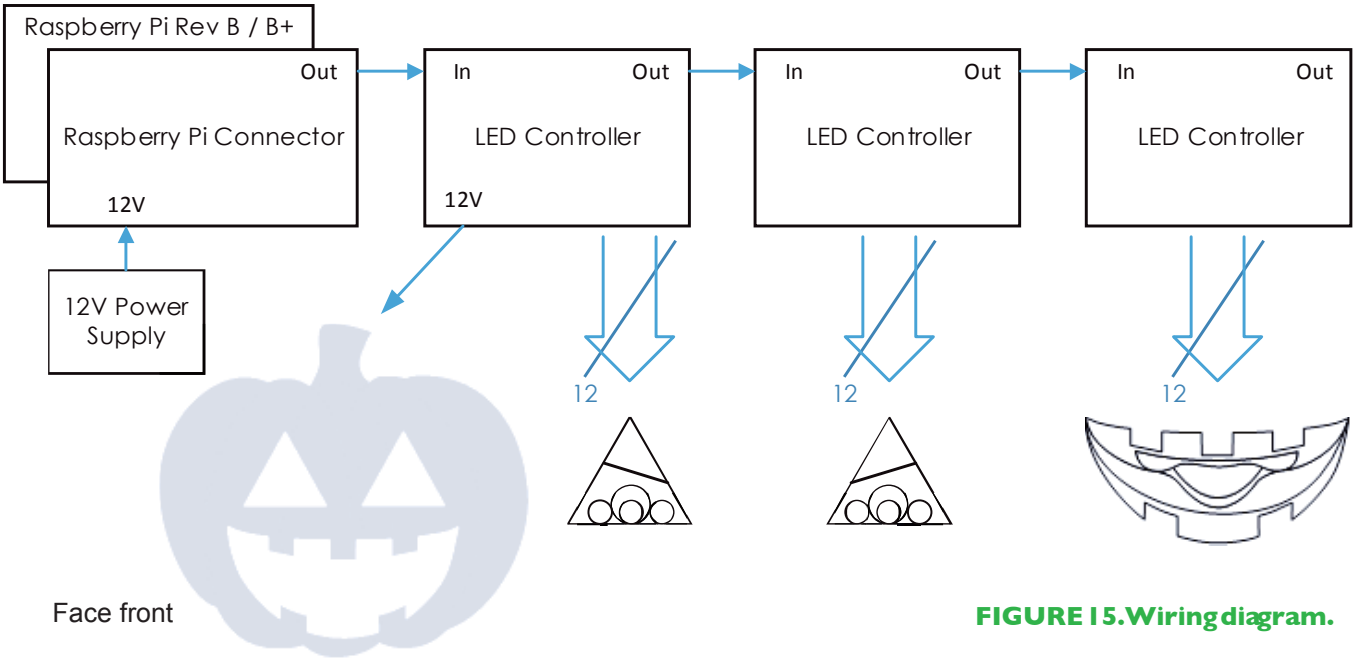
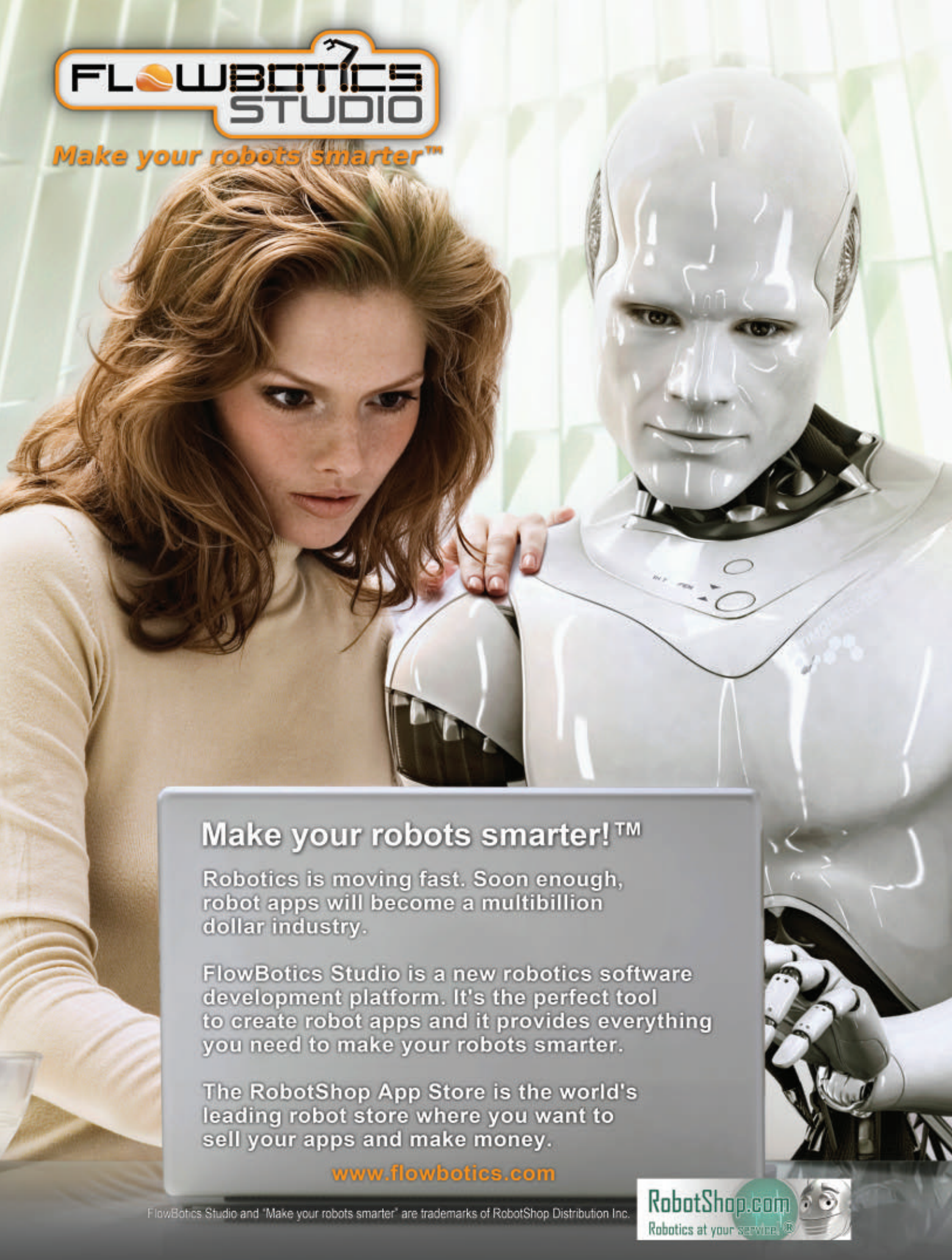


FIGURE 15. Wiring diagram.


FLOWBOTICS STUDIO
Make your robots smarter™
Make your robots smarter!™
Robotics is moving fast. Soon enough, robot apps will become a multibillion dollar industry.
FlowBotics Studio is a new robotics software development platform. It's the perfect tool to create robot apps and it provides everything you need to make your robots smarter.
The RobotShop App Store is the world's leading robot store where you want to sell your apps and make money.
www.flowbotics.com
FlowBotics Studio and "Make your robots smarter" are trademarks of RobotShop Distribution Inc.
RobotShop.com
Robotics at your service.®

Trio de los Muertos

By Marvin Niebuhr and Vern Graner

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Niebuhr**.

I grew up in south Texas just a few miles from the border with Mexico. The local culture was saturated with rich Spanish and "TexMex" traditions. It was quite common to have mariachis playing at wedding receptions, a Spanish polka band playing at high school graduations, or to spend an evening dancing at a neighbor's Quinceañera — a birthday celebration for 15 year old girls graduating into young womanhood. As such, it's probably no surprise that where I grew up, right after Halloween everyone would celebrate Dia de los Muertos or, the "Day of the Dead." Even though officially Dia de los Muertos was supposed to be a day for friends and family to remember those who had died, for most of us it was just an excuse to wear our Halloween costumes for one more day and to throw a big party!

Purposeful seeming animation using motors ... and psychology!

Dia de los Muertos celebrations are traditionally held on November 1st and 2nd, and extend all over the state of Texas. Since I moved from south Texas to central Texas, I have personally been to quite a few of these amazingly fun events in and around Austin. In the last few years, a talented artist and good friend of mine by the name of Marvin Niebuhr has made it a habit to bring some of his amazing kinetic art creations to some of the local events.

He has created elaborate costumes and sets with many different displays that reflected the Dia de los Muertos feel. He also started organizing his own party and show with audience members participating in live music jam sessions as all of his kinetic art displays filled out the stage show I have been lucky enough to be both an invitee and participant. This year, he asked for my help in creating a new art piece. He wanted to animate a set of three skeleton dancers to be featured at this year's Dia le los Muertos review at the Marcos Caliente Theater in Dripping Springs, TX.

He showed me some of his initial art pieces (**Figure 1**) and began to describe the motions he envisioned for the piece. Essentially, he wanted the motions to randomly go in and out of synchronization with the background music. At first, I began to evaluate using a microcontroller to drive an arrangement of servo motors or to move the skeletons using a pseudo random algorithm. As part of the testing, we stumbled upon a way to create pseudo random motions with an extremely simple crank mechanism and using only a single motor per skeleton.

Apophe ... what?

The fascinating part about this is

FIGURE 1. Laser cut foam core skeleton prototypes.

FIGURE 2. Tamiya electric motor gearbox kit.

FIGURE 4. Parallax Stingray high torque/low speed gearhead wheel motor

FIGURE 3. Assembled Tamiya gearbox mounted on the guitar player skeleton.

FIGURE 5. Cable clamp set yields three horseshoe shaped bolts and matching nuts.

FIGURE 6. Patio door rollers with ball-bearings and nut/bolt set.

FIGURE 7. Use a springpunch to help keep the drill from wandering.

FIGURE 8A. Horseshoe bolt fits perfectly on the 1/4" shaft of the gearhead motor.

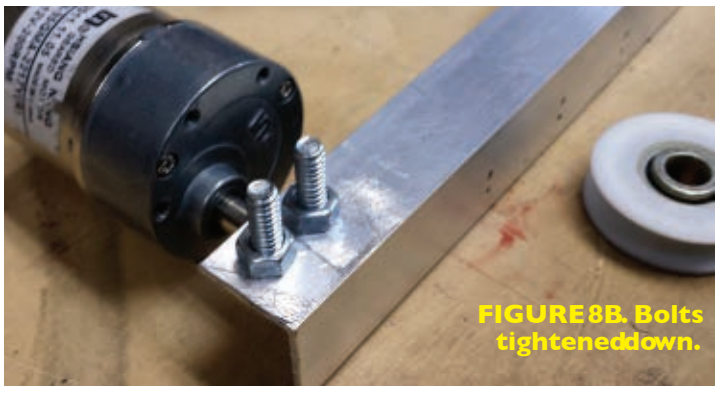


FIGURE 8B. Bolts tightened down.

FIGURE 9. The flatted shaft flush against the aluminum crank arm.

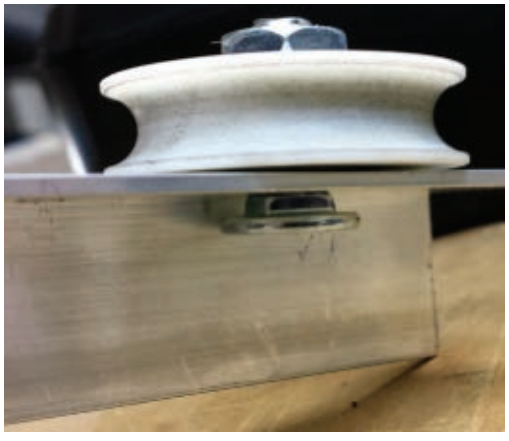


FIGURE 10A. Patio door wheel attached to the end of the crank shaft.

FIGURE 10B. Detail of the crank arm with mutiple holes to allow travel distance selection.

that — even though the dancers movements are essentially completely disconnected from any musical soundtrack — human observers tend to comment about how well the dancers seem to be moving in time with the music. They'll usually ask how we managed to get them to synchronize so well. Seeing patterns in random motions — even when none are actually present — is a psychological phenomenon known as Apophenia:

Apophenia is the experience of seeing patterns or connections in random or meaningless data. The term is attributed to Klaus Conrad by Peter Brugger, who defined it as the "unmotivated seeing of connections" accompanied by a "specific experience of an abnormal meaningfulness," but it has come to represent the human tendency to seek patterns in random information in general, such as with gambling and paranormal phenomena. (Definition courtesy of Wikipedia.)

Essentially, this means anyone can build animatronics, puppets, or marionettes that — to the observer — *appear* to have deliberate or pre-programmed motions when in reality the motions are nothing more than a simple motor and a crank!

Animation Motivation

In our trio, the guitar-playing skeleton is animated through the use of a Tamiya three-speed crank-axle gearbox purchased from Pololu (**Figure 2**). It was powered by adapting an old Nokia 3.5V 500 mA cell phone charger and connecting it directly to the motor. The

FIGURE 13. The completed Trio de los Muertos.

FIGURE 11. Patio door wheel with holes drilled for string anchoring.

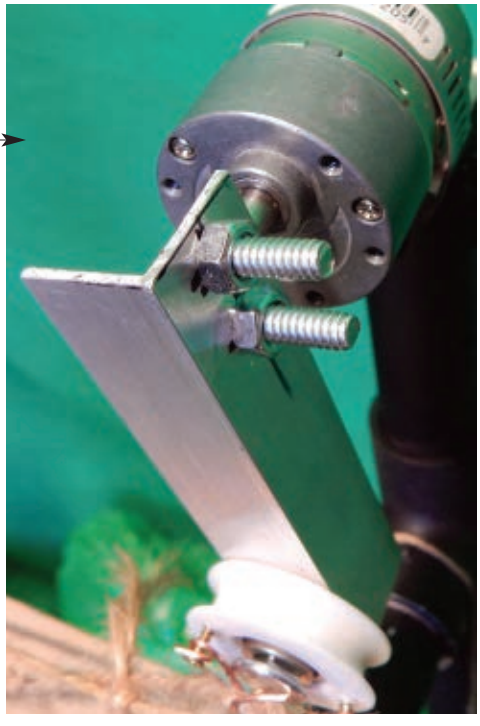


FIGURE 12A. Hose clamp around motor body and PVC pipe.

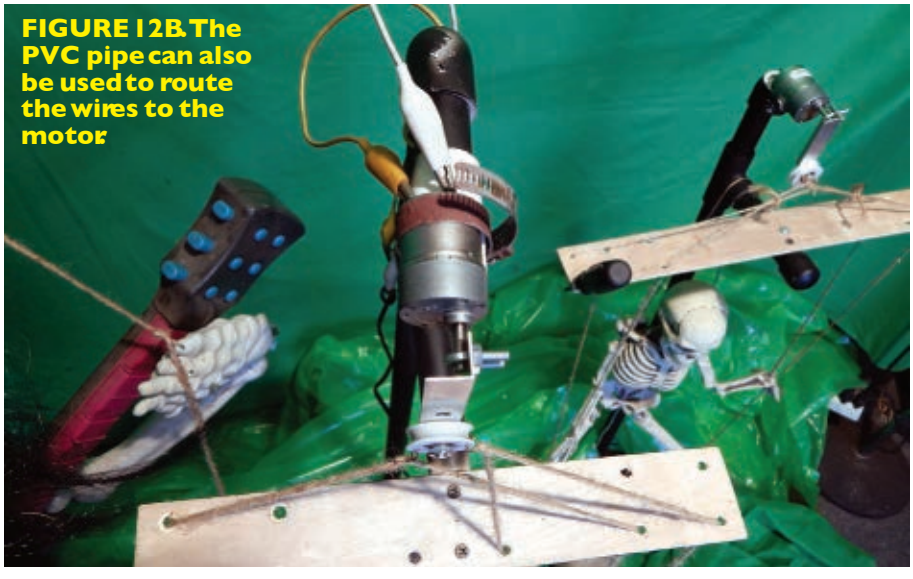


FIGURE 12B. The PVC pipe can also be used to route the wires to the motor.

Tamiya kit includes a crank arm fitting (**Figure 3**) to which we fixed the two strings which led to the hand on the fret board and the hand that would appear to strum the guitar. Even though the 3.5V cell phone charger provides just a little more voltage than what the motor is rated at, we didn't have any trouble with heat or excessive wear in our limited use. However, if you plan to run this little motor system for an extended period of time, you might want to play it safe and stick to the recommended 3V specified by the manufacturer.

For the two dancing skeletons, we used a pair of 200 RPM 12V gearhead motors I purchased from Parallax (**Figure 4**). These motors were used to drive the wheels in the now retired Parallax Stingray robot (see the June 2014 *SERVO Magazine* for a review of the Manta Ray — the Stingray robot's replacement). These high quality motors are actually a little high RPM for this application.

In order to slow them down a bit, we drove them with a pair of repurposed wall wart style 7.5V power supplies (see **sidebar** on power supplies). As these motors are discontinued now and they were a little fast for this application to begin with, I would suggest you look at some lower RPM motor offerings by some surplus electronics vendors (I've provided a listing of some suitable candidates in the **Resources** section).

Unlike the Tamiya gear motor kit which came with a pair of crank arms, the Parallax drive motors had a quarter inch flatted shaft and were simply used to directly drive

the wheels of the Stingray robot. Subsequently, we had to fabricate our own crank arm and pulley assembly for these motors. To do this, we purchased some angled aluminum, a cable clamp set (**Figure 5**), and patio door wheels (**Figure 6**) at a local home improvement store.

To create the crank arms, we started by cutting the angled aluminum to a usable size (roughly 12 inches). We then placed the horseshoe bolt from the clamp set onto the crank arm and marked where the two holes would go. We used a spring punch to create start points for the drill (**Figure 7**). After drilling the two holes, the horseshoe bolt is placed around the motor shaft (**Figure 8A**), the bolts are affixed to the other side, and tightened down (**Figure 8B**). Make sure the flatted part of the motor shaft lays flush against the aluminum bar to ensure the crank arm doesn't slip (**Figure 9**).

Next, we drilled a series of holes in the angled aluminum crank arm so we could select different travel distances for the anchor point. We then attached one of the patio door wheels to the end of the aluminum crank arm (**Figures 10A** and **10B**). Holes were drilled in the edge of the wheel to create points to which we could affix the strings (**Figure 11**).

Once we had both of the completed gearhead motor/crank shaft assemblies built, they were mounted with hose clamps to the tops of the stands holding the skeletons (**Figures 12A** and **12B**).

You've Gotta Dance Like Nobody's Watching!

The completed Trio de los Muertos works better than we could

RESOURCES

Tamiya Gearbox with Crank
www.pololu.com/product/67

Suggested Gearhead Motors

All Electronics
www.allelectronics.com/make-a-store/item/dcm-451/12vdc-60-rpm-gear-motor/1.html

Electronic Goldmine
www.goldmine-elec-products.com/prodinfo.asp?number=G17949

Marlin P Jones
www.mpja.com/12VDC-68-RPM-Gearhead-Motor/productinfo/15870%20MD

Video of the Trio de los Muertes Dancing
www.youtube.com/professorconrad

Marvin Niebuhr
www.ProfessorConrad.com

The Adventures of Marcos the Wise
www.amazon.com/Adventures-Marcos-Wise-Marvin-Niebuhr/dp/1627553843

have imagined (**Figure 13**). It is fascinating how — even though you are aware that each skeleton is operating in a non-programmed random fashion — it seems as if they move to and with a musical background. They even seem to synchronize with each other, having motions that are at first complimentary and then in counterpoint to each other. To get the full effect, I highly suggest having a look at the video (link in the **Resources** section) of the finished trio performing to an original sound track by Marvin himself. He's not only an artist, he's a musician too!

After you've built your own dancing skeletons or ghosts or spiders or whatever prop you've decided to animate, keep in mind the concept of Apophenia. This tendency of humans to find patterns in random motions could be very useful in other projects — artistic or not.

As examples, the random movements of a robot could be perceived as intentional, or random LED lighting patterns could be viewed as meaningful. There are lots of ways you can use this knowledge to your advantage in all sorts of human interface designs.

If you do come up with a project that takes advantage of this phenomena, please let me know! You can reach me via email at vern@nutsvolts.com. **NV**

A Note on Power

If you don't happen to have suitable power supplies in your junk box, I would recommend picking up a multiple-voltage power supply from a surplus electronics vendor. For example, All Electronics has the PX-17. This is multiple voltage power supply with selectable voltages of 3/4.2/5/6/7/8.4 VDC at a maximum current from 1.7A @ 8.4V to 2.5A @ 3V. It includes short-circuit protection and automatic overload cut-off, and is listed for under $10.
www.allelectronics.com/make-a-store/item/ps-17/multi-voltage-power-supply-w/tip-assortment/1.html

Some other suitable offerings are available from suppliers such as Marlin P. Jones ...
www.mpja.com/3-12V-2A-Selectable-Output-Supply/productinfo/9902%20PS

... and from Electronic Goldmine
www.goldmine-elec-products.com/prodinfo.asp?number=C7055

Of course, if you want some precise speed control, you could always opt for a PWM based speed control kit such as this one offered by Ramsey Electronics ...
www.ramseyelectronics.com/DC-Motor-Speed-Control-Kit/dp/B0002NRKGM

... or this one from QKITS
http://store.qkits.com/moreinfo.cfm/FA804

Lastly, if you don't plan to run your display for extended periods, you could always power these systems on batteries. The Tamiya gearbox should run well on two AA batteries, whereas the larger gearhead motors might need a bit more current. So, four C or D cell batteries might be in order.

Monster in a Box

By Jamie Cunningham

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Cunningham**.

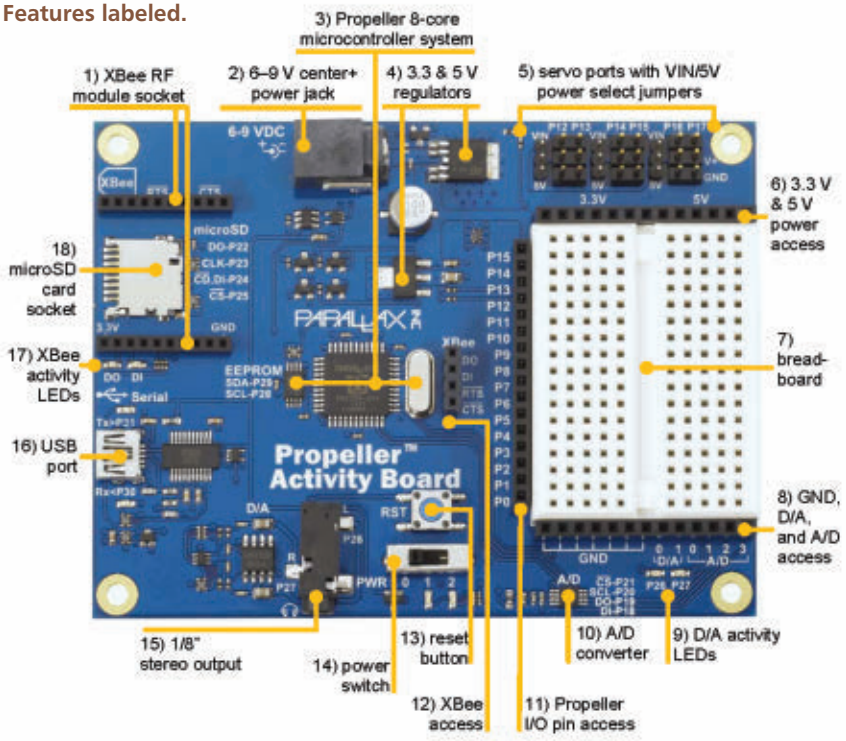
Underlying Technology: Microcontroller synchronized sound playback, low current to high current buffer system, programmable relay control, microcontroller triggering via passive infrared, driving stepper motors from microcontrollers, microcontroller switching of solenoid valves, and high voltage lighting.

Alternate Uses: Door monitor system at a retirement home that uses PIR to trigger audible voice prompt for an automatic door alert.

What did we miss? Do you have other ideas we may not have thought of? We're interested in how the technology showcased in this article may otherwise be applied. If you have ideas or comments, please send them to editor@nutsvolts.com.

Aaaaaaaaaaaaaaahhhhh!!! I love scaring kids! Ummm, what I meant to say is that I love the spirit of Halloween and giving the trick-or-treaters something fun to look forward to when they come to our house. Okay, the truth is every time I hear them scream, it is a nice little boost to my ego because it means I did a good job in making my Halloween prop!

Features labeled.



This article is about one prop in particular — the one that the first year I put it out, the kids didn't need to ring the doorbell because we could hear the screams before they even reached the door! A few kids would not even walk past it to come to the door, so I had to deliver the candy to them! The prop I'm talking about is my Monster in a Box (MIAB from here on out).

The idea behind it is there's a fire-breathing monster trapped inside a box trying to get out. Now, this is not my original idea. There are several MIAB props out there, although my take on it is a little different than others, and my implementation certainly is. If I can make something more complicated than it has to be, then I'm happy.

Part of my reasoning for making this more complicated is that I am always dying for a microcontroller project. The question for me is not "How can I make this happen?" It is "How can I use a microcontroller to make this happen?"

Most other MIABs out there involve hacking a drill or some other simple motor to turn a cam wheel with serrations on the edge, then have a cam follower that is attached to the lid which makes the lid go up and down. I saw an opportunity to use a stepper motor and microcontroller right there. I also needed sound and the ability to control a fog machine, strobe light, and a PIR sensor — so a microcontroller was the logical choice.

I'm getting a little ahead of myself. Let's back up to what I wanted the box to do. First, it had to be triggered by someone walking past it which would activate a whole slew of effects designed to strike fear in the heart of the victim, umm, I mean trick-or-treater.

Those effects would be: the box lid bouncing up and down, a red strobe light and fog machine (the fire breathing part), and a loud screaming animal sound.

A nice side effect of the fog machine is a loud hissing sound which really added to the audio effects of the box. Add some chains to the top to make it look like a dangerous monster is being contained and paint the words "Danger" and "Unknown Species" on the box and we're a go.

Parallax Propeller Activity Board
1. www.parallax.com/product/32910
2. www.mouser.com/new/parallax/parallax-propeller-activity-board/

Parallax Motion Sensor
1. www.parallax.com/product/555-28027
2. www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_2082927_-1

RepRap "StepStick A4988 Board or Compatible
1. www.sparkfun.com/products/11876
2. www.pololu.com/product/1182

YWRobot Quad Relay Board or Compatible
1. www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_239476_-1
2. www.mpja.com/Quad-Relay-Board-Fully-Isolated-Raspberry-Pi-Arduino-Compatible-Sensor/productinfo/31305%20MP/
3. www.allelectronics.com/make-a-store/item/mk-2633/relay-output-card-kit/1.html

12V Stepper Motor
1. www.mpja.com/Stepper-Motor-NEMA-17-12V/productinfo/18734%20MS
2. www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_238538_-1

110 VAC Strobe Light Xenon or LED
1. Ramsey Electronics http://tinyurl.com/omg74gh
2. www.canakit.com/variable-speed-xenon-tube-strobe-light-kit-ck483-uk483.html
3. www.parts-express.com/velleman-vdll24stu-24-led-white-mini-strobe-light--243-002

Smoke Machine
1. www.parts-express.com/talent-lm-1-little-misty-dj-fogger-400w-with-wired-remote--244-508

Audio Amplifier
1. www.allelectronics.com/make-a-store/item/amp-15/stereo-amplifier-20w/channel/1.html
2. www.parts-express.com/dayton-audio-dta-2-class-t-digital-audio-amplifier-module--300-385

5" Speaker or Equivalent
1. www.parts-express.com/boss-brs52-5-1-4-dual-cone-replacement-speaker--265-382

The Brains and Electronics

For the first version of the MIAB, I

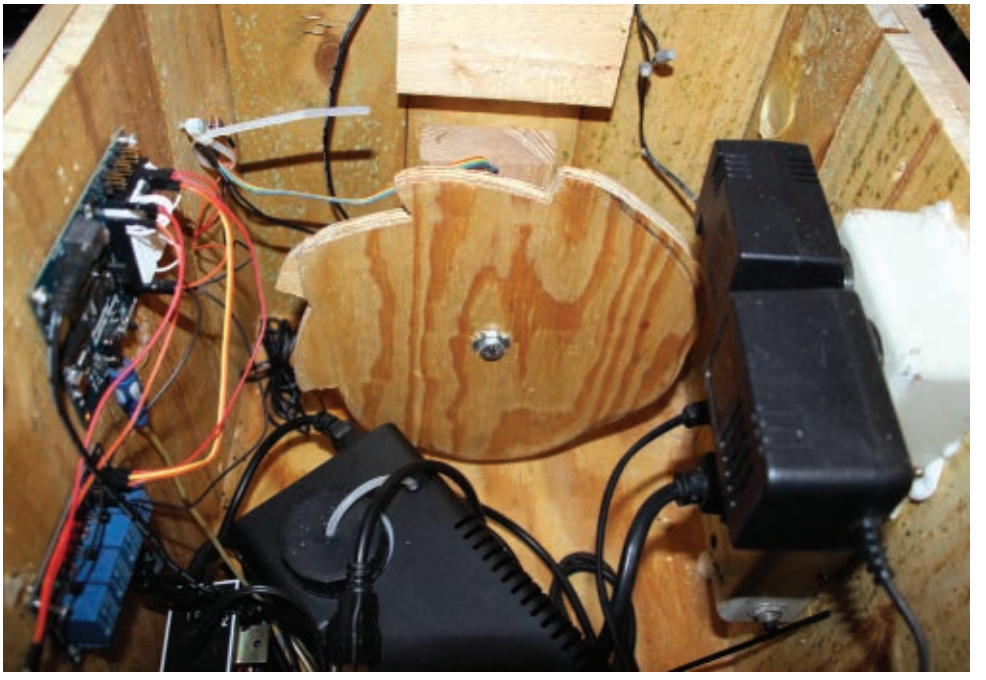
used a Parallax Propeller prototype board; for the audio, I hacked an old MP3 player. When I retrieved the box for the upcoming Halloween, the MP3 player was not working. I either had to hack another MP3 player (which was really quite hard) or find another solution.

Luckily for me, Parallax had just released their Propeller activity board which had all the audio stuff I needed right there. The activity board is the brains of the current MIAB.

In order to turn the cam, I decided to use a stepper motor and a Step Stick driver board. Initially, I wanted the monster to be in different "phases," and I was going to slowly turn the wheel back and forth in a slightly curved area of it to simulate a relaxed and "breathing" state where the lid would just slowly raise and lower. I later scrapped that idea, but still have that ability if I ever want to re-implement it.

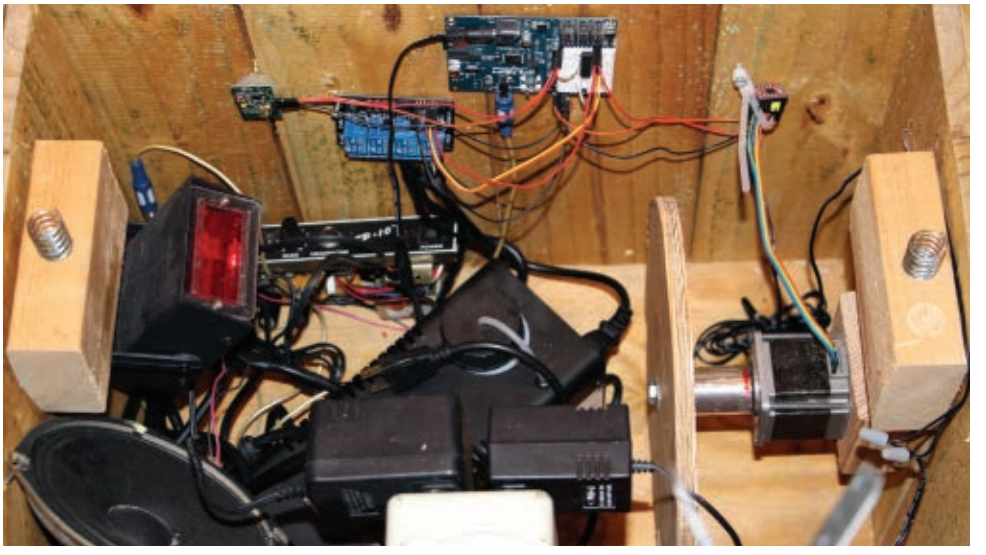
For detecting "victims," I used a PIR sensor. They are very simple and very reliable. Basically, it's wired directly to pins on the activity board.

To control the strobe light and fog machine, I needed to use a relay board. The strobe light didn't even have an on/off button; it was basically just plugged in. So, I spliced the wires and ran them through the relay board. The fog machine was a little more complicated as it had a remote that released the fog once the unit was heated up.



Here, you can see the teeth on the cam.

The entire contents of the box.



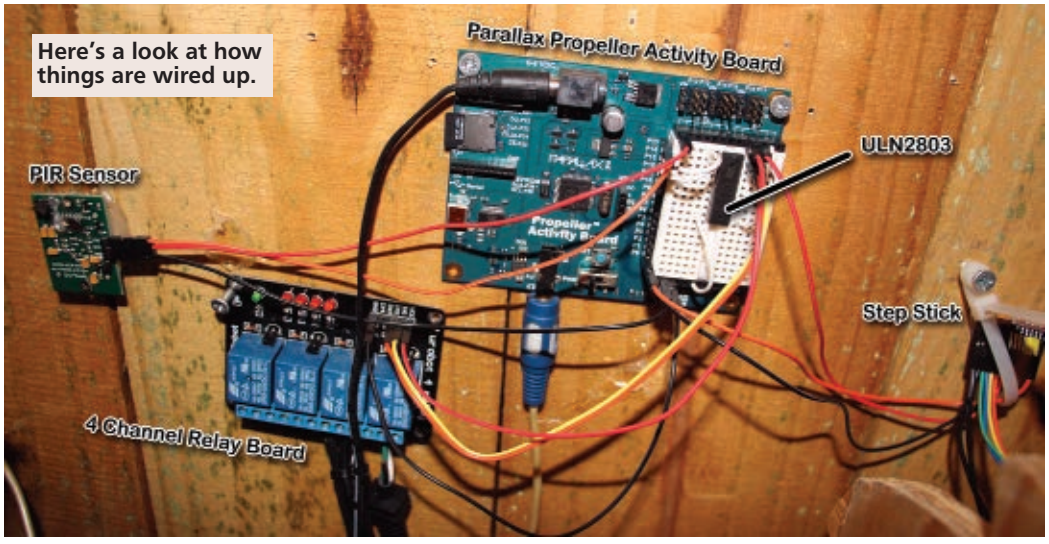
I hacked the remote section and ran that through the relay so the unit would have power to heat up and the relay would simulate pressing the remote button. Your strobe light and fog machine might be different, so it make take some trial and error to figure it out. However, with the activity board and a relay board, you should be able to control just about anything.

The last bit of electronics which has not been mentioned so far is the audio amplifier. The audio from the activity board is not nearly loud enough to make the kids jump out of their shoes, so I took apart an old guitar amp and put those parts in the box. (If there were room, I would have put the whole amp in there without taking it apart.) I did not alter the amp in any way, just took it out of its box and put the parts into mine.

As you can see in the photos, everything was glued and screwed to the sides of the box. I drilled a hole in the back bottom area of the box to run the power cord for the power strip.

Constructing the Box

The first thing I needed was the box — simple enough. I used some leftover wood from building a fence, but you obviously can choose any kind of wood that you can get



your hands on. The specific construction of the box is not important, but I made mine with four panels by laying out the width of the boards that I wanted, and then gluing and tacking the frame boards onto it. I'm not a woodworker, so there are probably better ways to build the box. However, mine is still together after two Halloweens.

Once I had the four panels, I then glued and tacked them together, and then glued and tacked this onto a plywood bottom. I made the top the same way but used hinges to attach it.

My goal was for the box to look like a crate that had shipped from some far away country where monsters still exist. In constructing your box, do some research on crates and pick a style that you like. Just make sure there is enough room for all the stuff that has to go in there to make it work!

The Bouncing Lid Effect

I wanted the lid to bounce up and down frantically, so I borrowed the idea from another MIAB project out there and decided to use a cam follower. Basically, it's a wheel with peaks and valleys.

Connected to the box lid is a bearing that rides up and down the peaks and valleys when the wheel turns, which makes the lid go up and down. Sharper peaks and valleys will make the wheel turn faster and create a more violent lid motion.

To construct the cam, I basically took a piece of plywood and used a can to draw a circle. I drew my peaks and valleys coming off the circle, and used my bandsaw to cut it out along the lines. It was not pretty but it worked.

I made a coupling to attach it to the stepper motor shaft, which is basically a piece of aluminum threaded on one end to mount the cam on to and a hole in the other end to mount to the stepper shaft.

Another idea was to glue and tack a block of wood to the cam, drill a hole the perfect size for the shaft, and use a screw to hold it tight. However, I worried this might not last as long, so I opted for the aluminum coupling. If you do not have access to metalworking equipment, this might be a good idea for you.

The Program

The program I wrote to control the whole thing is written in C, and is available at the article link.

Wiring

As far as wiring is concerned, you can wire things up as you see fit. As long as you change the program to reflect the different pins used, you should be good. Just in case you don't want to wire things up differently, check out the photos for how mine looks.

Four-Channel Relay Board

1. Place the ULN2803 on the breadboard and connect pin 9 to ground and pin 10 to five volts.
2. Wire the Propeller pin 13 to the ULN2803 pin 1 (to control the relay channel for the strobe).
3. Wire the Propeller pin 14 to the ULN2803 pin 2 (to control the relay channel for the fog machine).
4. Wire the GND of the four-channel relay board to GND on the Propeller activity board.
5. Wire the VCC of the four-channel relay board to a 5V supply from the activity board.
6. Wire pin 18 from the ULN2803 to IN 1 on the four-channel relay board (strobe).
7. Wire pin 17 from the ULN2803 to IN 2 on the four-channel relay board (fog machine).
8. Wire the strobe wires to the first relay block. Pay attention to the Normally Open/Normally Closed configuration. You want the Normally Open jacks (mine were next to each other).
9. Wire the fog machine wires to the second relay block.

PIR Sensor

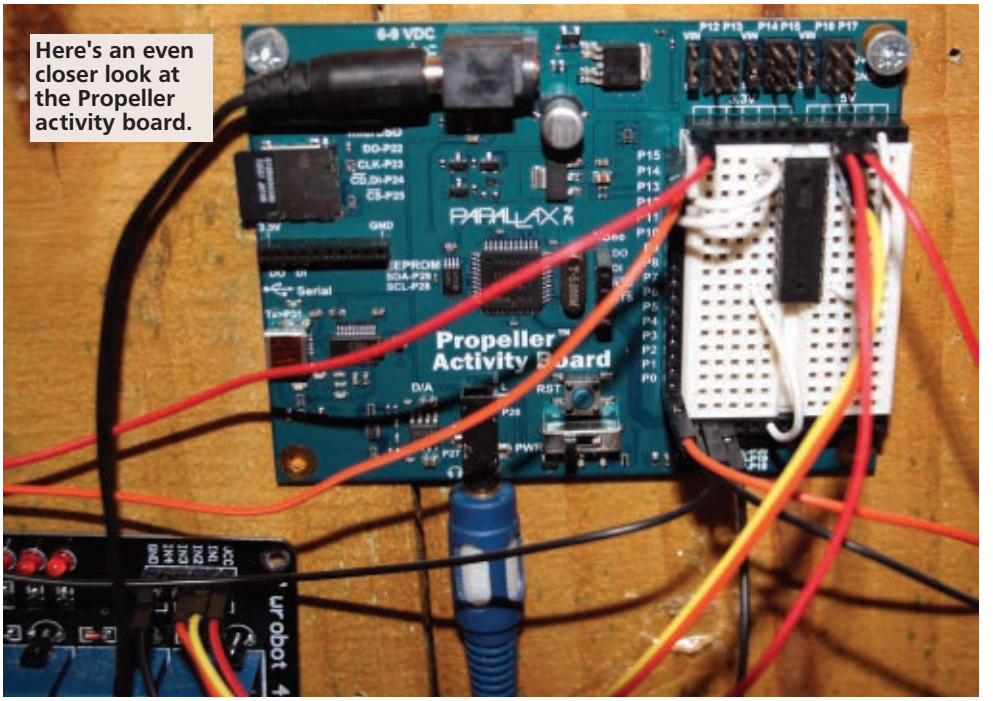
1. Wire the PIR sensor GND to a ground on the activity board.
2. Wire the PIR sensor VCC to a 3.3V supply from the activity board.
3. Wire the PIR sensor out to P15 on the activity board.

Step Stick

1. Each stepper motor is different. There are a ton of tutorials out there to figure out how to connect yours to a Step Stick, so wire your stepper motor appropriately.

2. I used a wall wart power adapter to provide motor power to the Step Stick. I basically spliced the wires from a wall wart into a female pin header connector. You could solder directly or use jumpers. It is better to give the Step Stick its own power and NOT draw it from the activity board. While you may get that configuration working, I found it to be a little buggy.

Note: If you are not comfortable or knowledgeable about splicing wires to anything, seek help from someone who does!



Here's an even closer look at the Propeller activity board.

3. Wire the VCC for the board power for the Step Stick to a 5V supply from the activity board. Again, you could draw the power for the board from the motor power but I found that buggy, as well.

4. Wire pin 0 from the activity board to the step pin on the Step Stick.

5. The Step Stick also requires a few jumpers. You have to at least jumper reset and sleep, or it will not work at all. If you want any form of micro-stepping, then you would have to jumper MS1, 2, and 3 to HIGH.

Audio

1. I used a 1/8" to 1/4" cable to connect the audio output from the activity board to the guitar amplifier.

2. I put my animal scream on a mini-SD and plugged it into the SD reader on the activity board.

So that's it — an overly complicated Monster in a Box project. It's probably more of an exercise in using the activity board to control a myriad of effects than it is on how to most efficiently make a Halloween prop. If you are reading this magazine though, I'm guessing you appreciate overly complicated projects just like me. **NV**

To see the Monster in a Box in action, go to **www.youtube.com/watch?v=2pkMfcFDVvs&list=UUTCJzOsWrxeE4d_-BdDvhDA&feature=share&index=3**.

To see any of my other projects, check out my website at **www.backyardworkshop.com**.

Automating Your Haunt Using PICAXE Microcontrollers

Did you ever have that one house in your neighborhood that always went the extra mile at Halloween? The "scary" house that you couldn't wait to visit when the big night finally arrived? Well, as a kid, I did and I've always wanted to create that atmosphere for the kids in our neighborhood that provided just enough scare to be a thrill and keep them coming back year after year.

We started decorating for Halloween in 2010, and have two parties each year with the largest often drawing over 125 friends, family, and neighbors. For our parties, I wanted to turn on my haunt and be able to enjoy the evening with my guests. So, all our props are independently operated using controllers I've designed and built. With no actors, I never have to worry about who or how many will show up, whether they'll stay in character and in their spot, or wonder how much pizza and soda I need to have on hand to keep them fed. I just turn everything on at the beginning of the night and unplug it all when everyone has gone home (**Figure 1**).

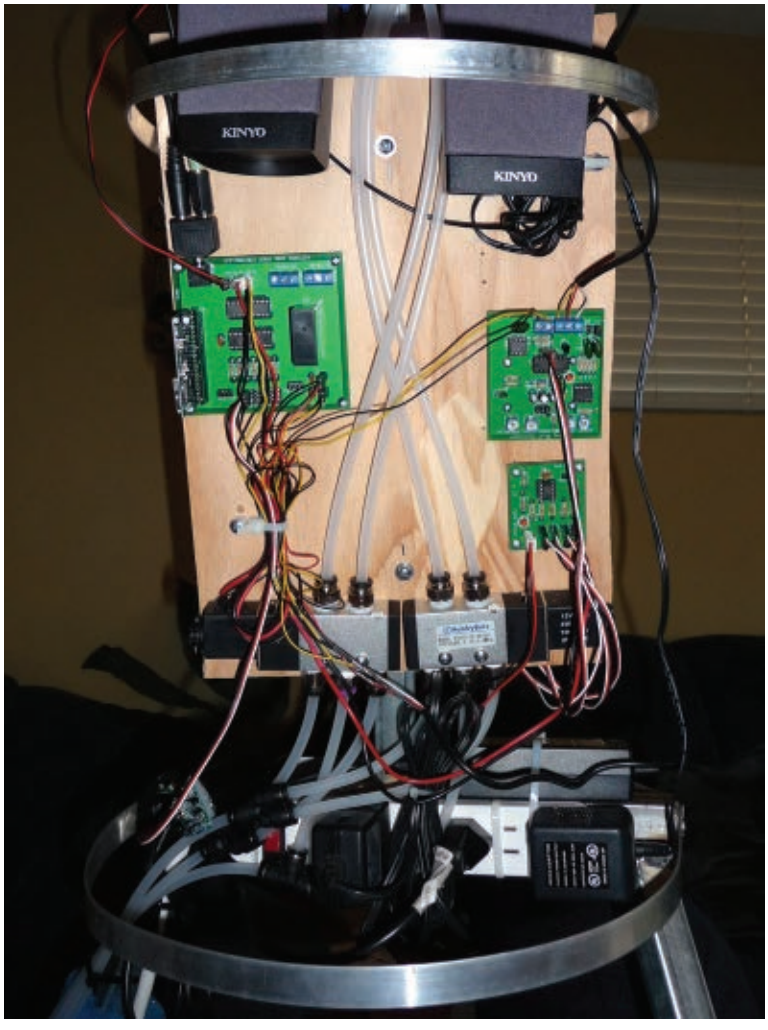


FIGURE 1. An example of the complete brains of one of my props.

PIRATES, WITCHES, AND GHOSTS ... OH MY!

Growing up in southern California, I was deeply influenced by the Haunted Mansion and Pirates of the Caribbean at Disneyland. We decided that our haunt would be modeled after those attractions, and would provide plenty of scary props but without blood and gore. We felt we should leave that to others that can do it so much better than we are able to do.

Not one to do something half way, I jumped in

with both feet and set out to make my grand Halloween plans a reality. Having a garage full of tools and already being handy with their use, I decided early on that I wanted to make my props versus buying ready-made ones. This way, I was confident in the quality of the build and if anything did break, I'd know how it was built and would be half way to getting it fixed.

I quickly discovered that building the props was the easy part. More difficult and potentially much more expensive would be figuring out how to control them.

There are many very good premade controllers on the market and I tried a lot of them in the beginning, including the Prop 1 from EFX-TEK and the PicoBoo from Fright Props. Both are excellent companies that produce great products and provide lots of help for setting up their respective controllers. EFX-TEK's online forum is fantastic with plenty of knowledgeable members willing to help with the necessary programming to get your controller up and running.

Even though all of them did what they were advertised to do, the cost was putting the brakes on my prop building plans. I set out to see if there were any alternatives, and soon discovered DIY microcontrollers.

Using microcontrollers required me to learn several new skills and purchase additional tools. That alone was incentive enough, because who doesn't need a reason to buy more tools? I've always been handy at building and repairing things, but this was brand new territory. I don't have a programming or engineering background and didn't speak the language. I'd need to learn the uses for all sorts of cool sounding components like resistors, capacitors, op-amps, and potentiometers, as well as how to design the controllers so they could be made into printed circuit boards (PCBs). Refer to **Figure 2**.

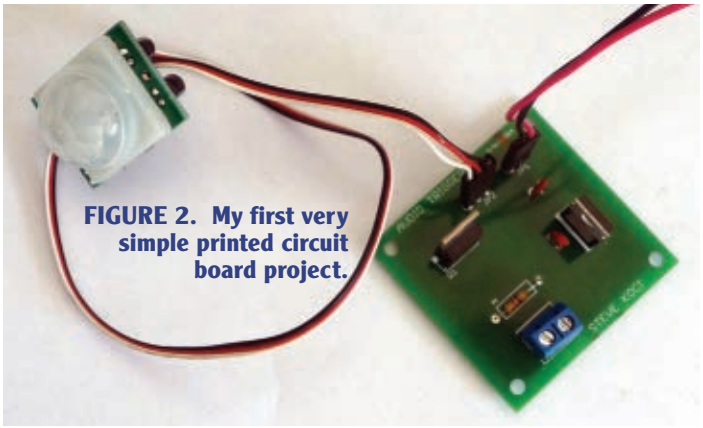


FIGURE 2. My first very simple printed circuit board project.

PICAXE TO THE RESCUE

What I needed was an inexpensive and easy-to-understand system that I could learn through researching on the Internet. I soon came upon the PICAXE which was originally designed to introduce school kids to the world of microcontrollers. I decided if they could figure it out, I should be able to as well. Like so many others, I found it was perfect for my needs, with plenty of power and features to run all the props and scenes in my haunt.

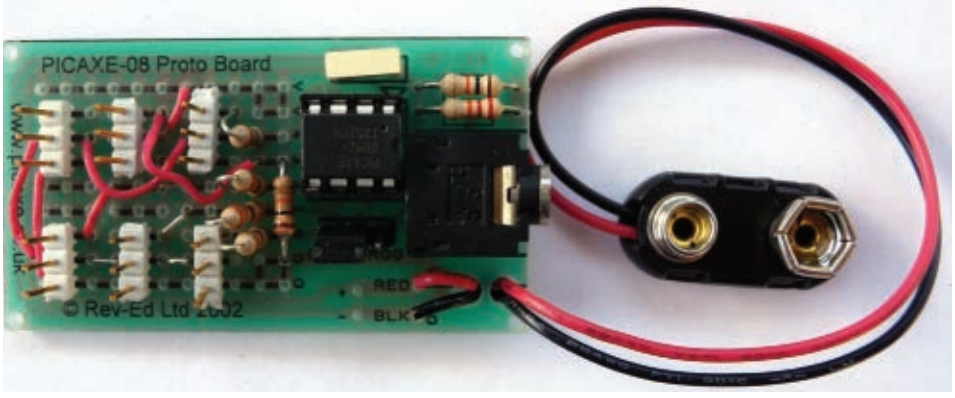
PICAXE chips come in a variety of sizes to fit just about any project; choose the one that best fits your needs. The ones I find myself using the most are the 08M2+, 14M2, and the 18M2+. The chips come preprogrammed with the necessary firmware, and only require an inexpensive USB cable to download programs. These are only about $22 from RobotShop (see **Resources**). If you want a DIY version, check out the July issue of *Nuts & Volts* for a tutorial written by Tommy Tyler. (*Nuts & Volts* also has a bi-monthly column dedicated to this microcontroller called the PICAXE Primer.) You can build your own for almost a portion of the cost, and gain the satisfaction that you did it yourself.

EVERYTHING IS UNDER CONTROL

The first PICAXE project I did was one put together by a fellow Haunt Forum member (see **Resources)**. This forum has been my main inspiration and source of help as I've traveled this spooky road. I was fortunate enough to discover it when I started to build my haunt, and have found a wealth of information and more ideas for props than I'll ever have time to build. Mike Langensiepen calls his board the VLC (Very Low Cost) controller. It takes one of the 08 prototyping boards and allows you to utilize four pins. These boards are around $4 from RobotShop. I have built several of these boards and they are still in use in my haunt today (**Figure 3**).

Although these worked fine, I wanted a board that was quicker and easier to build as I really don't like having to use jumper wires. That's when I decided to learn how

FIGURE 3. The PICAXE board that started it all for me: the VLC controller.



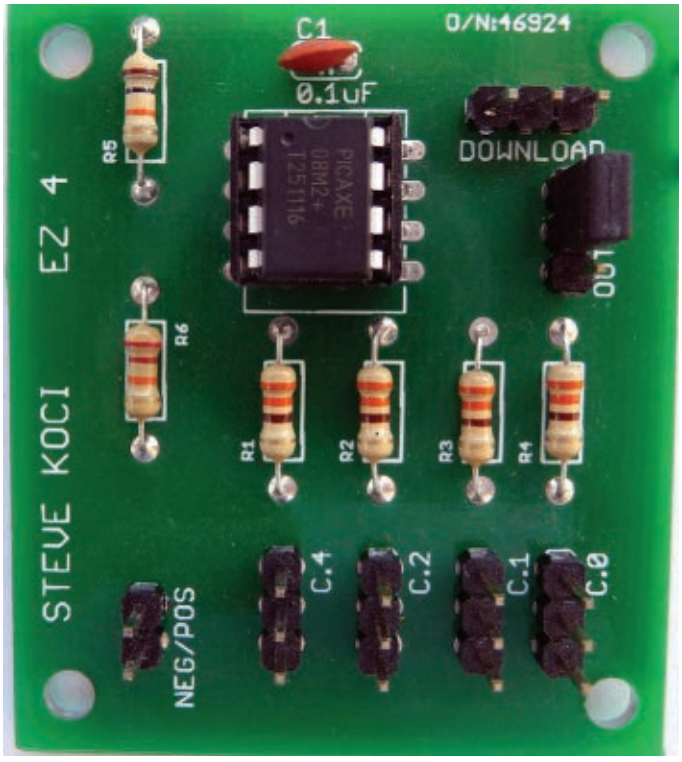


FIGURE 4A. The original EZ4. Basic, but still useful.

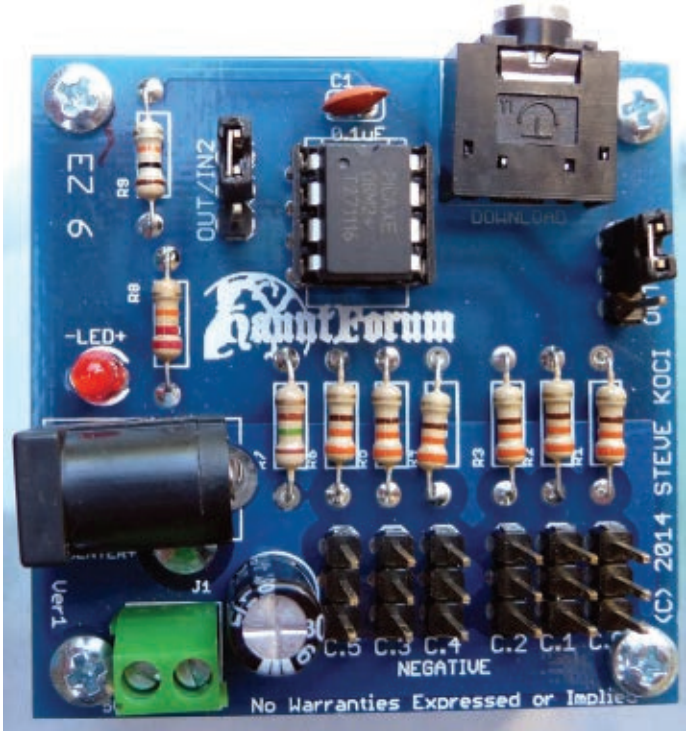


FIGURE 4B. The current upgraded EZ6 has come a long way from its humble beginnings.

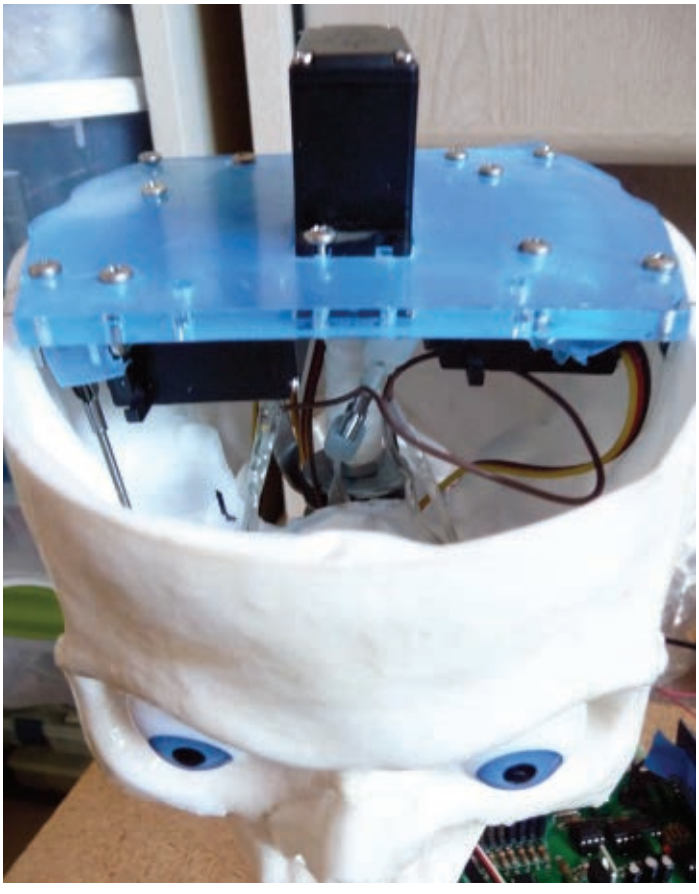


FIGURE 5. The inside of the skull using the Triaxial skull kit for the three-axis mechanics.

to design my own boards and have them made into PCBs. I was able to find some help on various forums from users of the Eagle software (see sidebar), so that's the program I chose to go with.

After many nights with little sleep, I felt I finally had a PICAXE board that was ready to share. I proudly posted it so all my mentors could see it and sing its praises. Sadly, it was not to be. Suggestions included cleaner layout options, better ways to run my traces, and improvements to consider in future revisions. I quickly learned that you must be ready for alternate ideas and constructive criticism if you're going to make your designs public. Although I was a little disappointed, I took my list of suggestions and made the necessary adjustments, and the EZ4 came to be. As a result, I had a better board design and I had learned some valuable lessons.

The board worked fine but new ideas for its improvement came to mind, and now the board has a power light, a download jack instead of header pins that require an adapter, dual power inputs, and access to six pins instead of only four (**Figure 4A** and **Figure 4B**).

This board has many uses. I primarily utilize it to run LED lights like my fireflies and bat eyes, or to run a random head code for a three-axis skull (**Figure 5**) or other servo projects like my Parrot (**Figure 6**). When I began

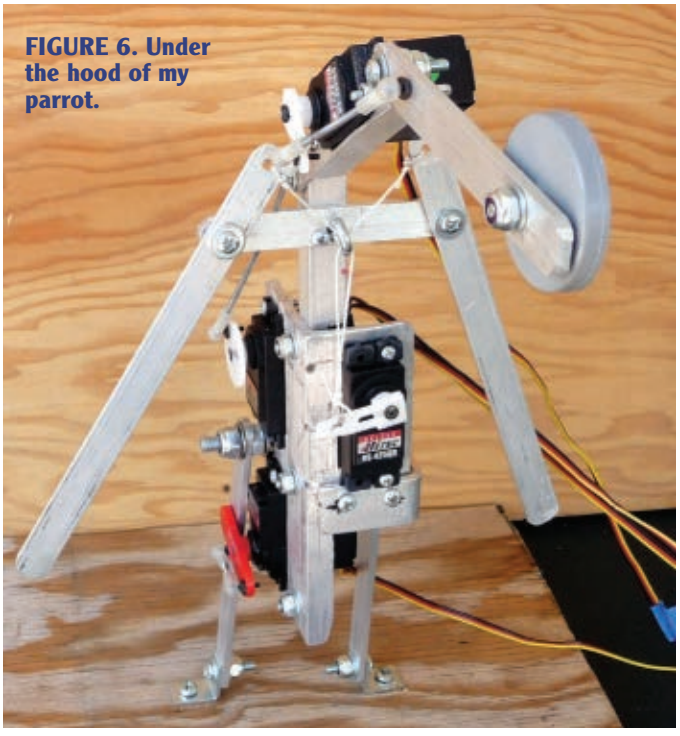


FIGURE 6. Under the hood of my parrot.

working on my first three-axis skull, I followed the conventional method and used several different software programs. These included VSA and products from Monkey Basic (see **Resources**), along with a joystick to set each individual movement for the nod, tilt, and rotate servos.

RESOURCES

Haunt Forum
www.hauntforum.com/index.php

Download cable from RobotShop
www.robotshop.com/en/picaxe-usb-stereo-download-cable.html

Video of EZ4
http://youtu.be/HKpKMvk1EM8

EEVblog's soldering tutorial part 1
http://youtu.be/J5Sb21qbpEQ

Video of the complete parrot prop
http://youtu.be/CzWfadElhN4

Parallax PIR sensor
www.parallax.com/product/910-28027

08 prototyping boards from RobotShop
www.robotshop.com/en/picaxe-08-prototyping-board-kit.html

Eagle PCB development software
www.cadsoftusa.com

Brookshire Virtual Show Animation (VSA) software
www.brookshiresoftware.com/vsa_overview.htm

Monkey Basic Trackskull software
www.monkeybasic.com/Products/TrackSkull/#.U6IQjUAuKjU

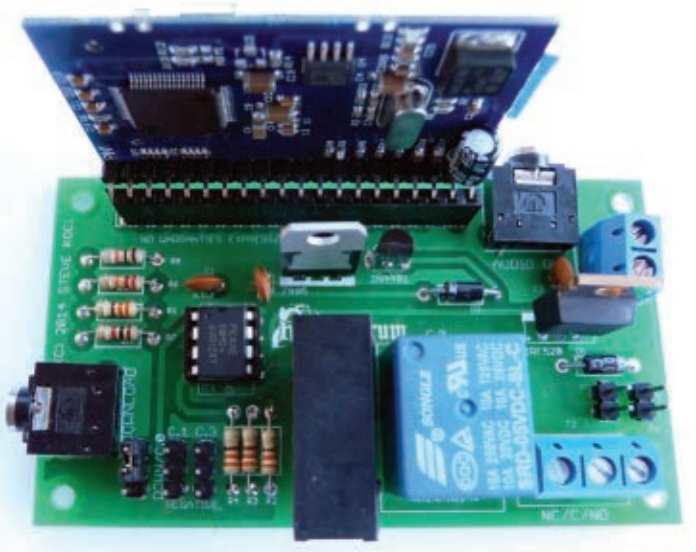


FIGURE 7. The simple prop controller — my most used board.

Through my work and while observing others setting up their routines, I found that most people didn't really need that kind of control. What most of us were trying to achieve was just random movement since we really didn't know where the guests would be in relation to our props. We just wanted our characters to appear lifelike.

I began trying to figure out how to program my PICAXE for random movement of the three servos and found that much of the work had already been done. Joseph Maddalena — also known as Hpropman on the Haunt Forum — had some code that would do just what I was looking for. He made the code available and I use it for the basis of the code I run many of my props on.

Building on the success of the EZ4, I soon decided I needed a board that would be versatile enough to control a variety of basic props. I wanted it to include a stereo sound card, be able to be triggered by a PIR (passive infra-red) sensor, have a three-pin servo header, have a 12V/110V relay, and be able to run a 12V motor or light. You probably would never use all of these at the same time, but I wanted them available. This became my simple prop controller. It's the board I reach for the most often when building a prop (**Figure 7**).

As I became more confident in my design skills, I decided to try my hand at building a button banger controller. The button banger style of controller does not require the end user to do any programming as it's already on the chip. Once the PICAXE chip is programmed with the basic code, the actual routines are added by just pushing a few buttons in the desired sequence that triggers the appropriate relays which are connected to your prop motors, lights, or solenoids. There are several great controllers like this on the market, but I thought they could be made better.

First, I wanted to bring my cost down and I also

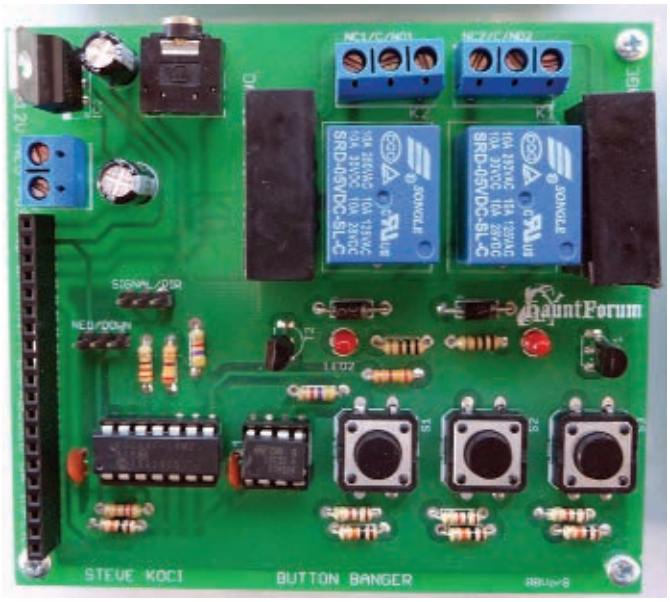


FIGURE 8. My button banger now with several improvements over the original.

wanted to improve the sound quality. The ones I'd found all used mono sound and the biggest complaint I'd heard regarded the poor sound quality. I began my design and once again found a fellow haunter working on the same concept. Chris Mekeel began work with a PICAXE but he decided to continue in another direction. I stayed with the PICAXE and soon had a working two-button banger controller with stereo sound (**Figure 8**).

One exciting result of this was that my design was taken to the next level by another haunter and the result is an even better controller. Tyler Straub (tstraub on the Haunt Forum) didn't use a PICAXE chip but he did make several significant improvements including making it a four-channel button banger (see **Resources**). This is exactly the kind of cooperation among builders that allows us to collaborate and continue to raise the bar on the effects we're able to accomplish.

These successes were all leading to the board I'd always wanted to have. Since many of my props included three-axis movement, I wanted a board that was totally stand-alone and wouldn't need to be connected to a computer to run. I also wanted to be able to control not only the three-axis movement but to have an onboard stereo player and be able to have a jaw respond to the audio track. I was already doing this by employing the EZ4 (a Scary Terry board like the one featured in Vern Graner's September 2008 *Nuts & Volts* article "The Talking Skull Kit") to control the jaw movement and a simple prop controller to provide the audio and monitor the trigger inputs. It worked but it was unwieldy and required lots of wires to connect it all.

The single board solution became Frankenstein (**Figure 9A** and **Figure 9B**). Once this board is programmed with the already written basic code, only the

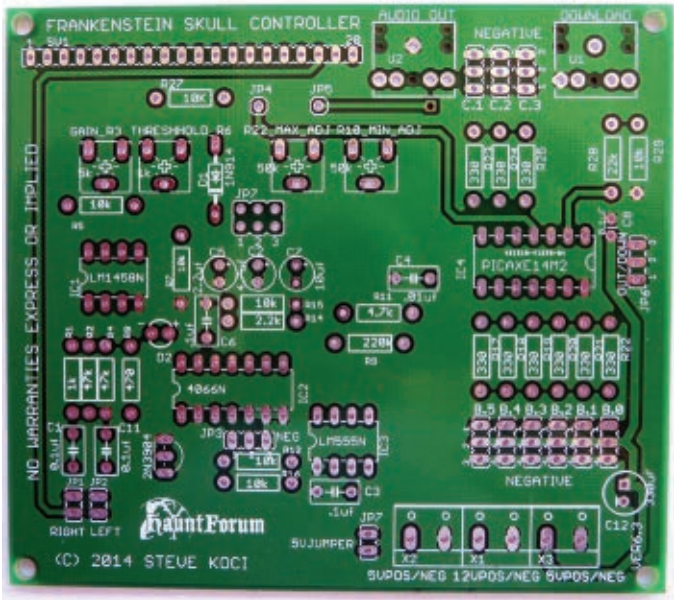


FIGURE 9A. The Frankenstein bare board.

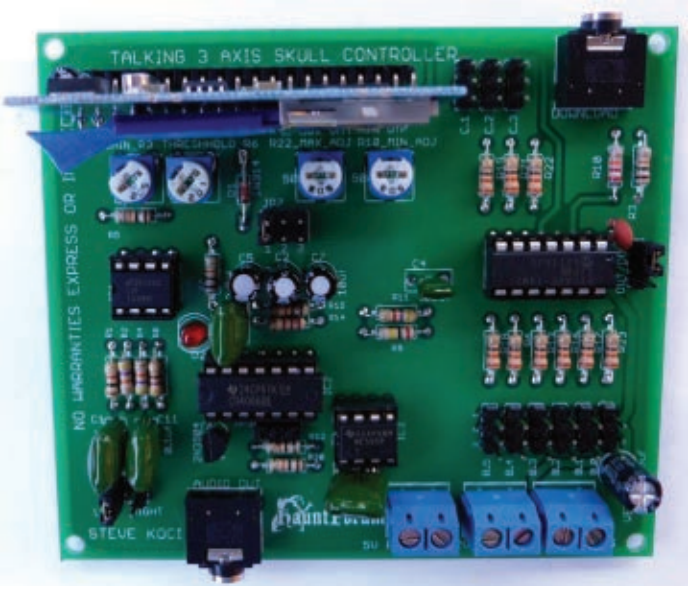


FIGURE 9B. Frankenstein fully built up, in all his glory.

servo limits and timing needs to be adjusted as each skull and routine is different. This is very easy to do and can be completed in a few minutes. Using a servo tester such as the one designed by Tyler Straub makes this a breeze (**Figure 10**).

The source code I use is available for download at the article link. It's provided under a Creative Commons License, and you're free to use it as long as it's for noncommercial use and you are willing to give credit and license your new creations under the same terms.

FIGURE 10. Tyler's DIY servo tester.

DIGGING UP THE PARTS

I've tried to minimize the number of places I need to shop from in order to gather the necessary supplies needed to build my controllers. Many of my power supplies are recycled wall warts. These are the cords with the box-like plug that comes with most consumer electronics today. I always salvage them when disposing of any electronics and am always on the lookout for more. Friends and family now save them for me, as well.

Be sure you use the correct voltage which should always be checked with a voltage meter. Don't trust what the label says as the voltage can often be significantly higher than stated. Using a supply with too high of voltage can damage your components and let out the "magic blue smoke."

The SD cards used in audio players are the same ones used in many cameras. You may have extras lying around the house, or they're easy enough to get at most department or drug stores. The PIR sensors I use are available from Parallax (see **Resources**). Some of these components are available on eBay, but oftentimes the long wait times and not having the opportunity to talk with someone regarding any issues keeps me from using that option. All the electronic parts except for the PICAXE chip and the audio board come from the same supplier.

Even so, the shipping costs can add up, so I try to plan my parts needs for the season and order enough plus a few extras at one time.

Knowing how to solder is a necessary skill. While having someone teach you at your side will speed up the learning process, I learned by watching online videos. One of my favorite tutorials for soldering is done by Dave from the EEVblog (see **Resources**) His three-part series covers tools and materials, as well as basic and surface-mount soldering.

IT'S ALIVE!

This process has been highly rewarding and satisfying. The lessons I've learned have allowed me to build controllers to do exactly what I need and to keep the cost in a range that I can afford. It's a never-ending process as I continue to improve my current boards and develop new ones. In fact, I've teamed up with another haunter to create an even more user-friendly Frankenstein board which will allow just about anyone with soldering skills to get a three-axis skull up and running in a day.

If you have any questions or would like to discuss the many uses of the PICAXE microcontroller or any other projects, please come and visit the *Nuts & Volts* forum. We're all here to help out and have fun! **NV**

RUBY'S FLAME

By Don Powell

Post comments on this article and find any associated files and/or downloads at www.nutsvolts.com/index.php?/magazine/article/september2014_Powell.

A friend of ours, Ruby Joule, who is a dancer in the world famous Jigglewatts Burlesque Troupe from Austin, TX asked if we could help her with a prop she wanted for her stage act. She had been wanting to do something involving fire, but most venues tend to frown upon using real flames. She had seen photos of some of the Halloween props we had built, and asked us if we'd be interested in fabricating something for her. She wanted us to create a four foot tall faux flame prop. It needed to be easy to carry on and off stage by anyone immediately after her performance was completed. This was important as the stage has to be clear for the next act. This also meant it needed to stay cool all the time (no halogens) and be rugged as it would be subject to road life abuse and the occasional clumsy stagehand. We went through a few different designs, but eventually made the stage prop now known as "Ruby's Flame."

We've had a lot of requests from others who have wanted to build this for their home haunts, and recently by a few drama teachers who wanted to use it in some school performances. One of them told us it was the hit of their play. Thanks for the inspiration, Ruby!

We won't go into the details of how to construct the actual enclosure here, but will discuss the electronics and attachment of the flame. If you are interested in the full enclosure/build details, go to the article link for an extended version of this write-up with more info and photos.

BUILDING THE LIGHT HARNESSES

We'll begin with the light harnesses utilized. Start by taking about one foot of black wire and soldering it to one of the wires from a GU10 socket. It doesn't matter which wire you use (**Figure 1**).

Next, take about one foot of white wire and solder it to the other wire on the same GU10 socket and cover these solder joints with shrink wrap (**Figures 2** and **3**). You will now need to cut a second piece of black wire approximately one foot long. Solder the two black wires together with one of the wires from a second GU10 socket (**Figure 4**). Now, do the same thing with a piece of white wire. Cut a second piece approximately one foot long. Take the GU10 socket and solder these wires together with the remaining wire from the second GU10 socket (**Figure 5**). Shrink wrap both of these solder joints. This will complete the first of two wiring harnesses you will need to make for the GU10 LED lights. **Figure 6** shows a shot of the completed wire harness.

You will need two wiring harnesses, so repeat the steps above and set them aside for now.

MAKING THE LED SPOTLIGHT HOLDERS

To make the spotlight holders (**Figure 7**), you will need to use a step drill bit (**Figure 8**) and enlarge the hole in a shallow flange so the opening is the same size as the lens on the bulb (**Figure 9**). The easiest way we found to do this is to take a short piece of 1-1/2" PVC and place the flange on top; it will slip over the end of the pipe. Then, drill out the hole with the step bit. If you have a drill press, it will make this easier, but it can be done with a handheld drill if you are careful.

Repeat this for all four of the necessary flanges and set them aside for now. We ended up painting all of the parts black so they would disappear when the flame is on. This is a good time to paint parts if you choose to do so. The GU10 LED lightbulbs fit perfectly inside of 1-1/2" PVC/22-1/2 degree angled Els. They are also the perfect angle to shine onto the silk flame. The GU10 socket will come up from below the top panel of the enclosure, through the PVC EL. When the LED is attached, the bulb will sit perfectly inside


FIGURE 7. LED spotlights in action.


FIGURE 1. Solder the black wire to the GU10 socket.

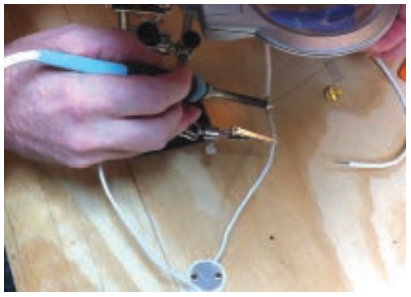


FIGURE 2. Solder the white wire to the GU10 socket.


FIGURE 3. Shrink wrapping the wires.


FIGURE 4. Solder the second black wire to the second GU10 socket.

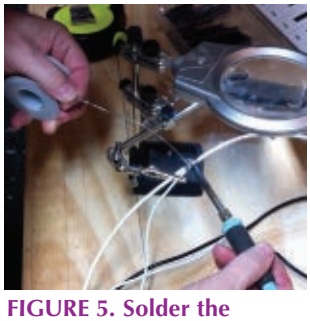


FIGURE 5. Solder the second white wire to the second GU10 socket.


FIGURE 6. A completed lighting harness.


FIGURE 8. Step drill bit.


FIGURE 9. The shallow flanges before and after expanding the size of the hole.


FIGURE 10. Connecting the GU10 bulb to the GU10 socket.

FIGURE 11. Attaching the shallow flange to the PVC light holder.

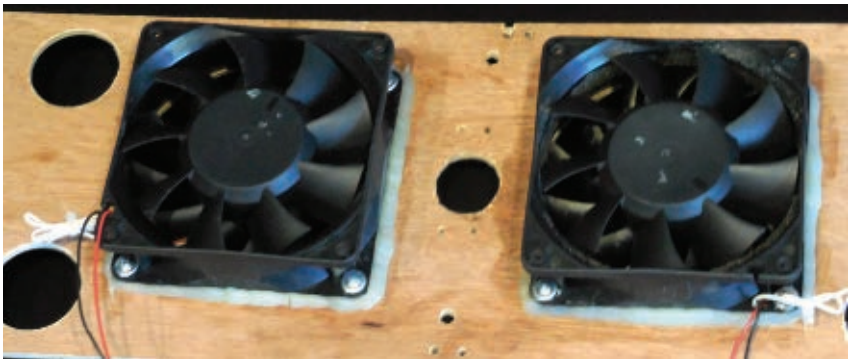


FIGURE 12. Both fans mounted to the top panel of our enclosure with screws and clear silicone caulking.

the angled El (**Figure 10**). You can then cut a small disc of lighting gel and place it on the bulb to take intense heat away. However, these LEDs barely get warm. Next, take the coupling flange you drilled out earlier and snap it onto the flange to secure the gel and bulb in place (**Figure 11**).

The flange itself will lock onto the PVC El, so no glue or fasteners are needed. Besides, you might want to alter the color of the flame at some point. We will eventually position the Els and then glue the base to the top panel of the enclosure, but we'll do that later once the silk that creates the flames is actually flying. The assembly of the spotlights will be part of the final assembly and wiring.

INSTALLING THE FANS

The particular fans we use are very dangerous when spinning and could probably take off a finger, so always use extreme caution!

The fan's casing is square and the holes we drilled are round, so we used all-purpose silicone caulking to help plug up around the fans and also to assist holding them securely to the top panel. We'll use four 1/2" lath screws per fan to secure them, as well.

Start by drilling some very small holes into your enclosure. Make sure each corner lines up with the holes in the corner of the fan so you can put a screw into each hole to secure it. You will also want to make sure that the fans are facing the correct direction so when they spin, the air flow will be blowing where it's supposed to. Usually, the label side is what you want to see when it is mounted to the top and flipped back over to the operating position.

Make sure to fill in any open spaces around the hole so you don't lose any air flow (**Figure 12**). Once this is done, flip the panel over and smooth out the silicone. Set the piece aside to dry overnight.

HACKING A PC POWER SUPPLY, THEN CONNECTING BLUE LEDS AND FANS

We used a standard ATX computer power supply with two 12V rails since the fans both run on 12V and use a lot of power. We also connected the two 10 mm blue pre-wired LEDs to one of the 12V rails. The LEDs use so little power they can share power with no noticeable loss in performance to the fan or the LED.

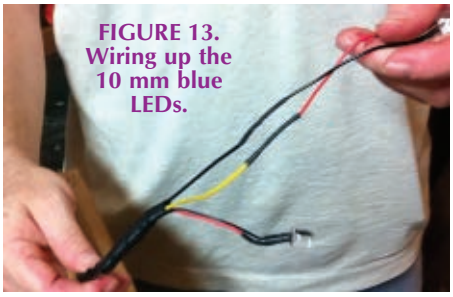


FIGURE 13. Wiring up the 10 mm blue LEDs.

For this project, you will only need to use the yellow 12V wires, the one green wire, and the black ground wires. You will also need a 10 watt/10 ohm sandbar resistor. The red wires are 5V and not needed for this build, so they can be cut back and shrink wrapped with the other wires. The two yellow 12V wires will power the blue 10 mm LED lights and the two fans.

The LEDs we used came pre-wired with a resistor, so we just soldered the red wire from the LED to one of the yellow wires, and the black ground wire from the LED to the other ground wire. Don't forget to put shrink wrap on the wire BEFORE you solder it. Otherwise, you will have to unsolder it to put the shrink wrap on and then resolder it (**Figure 13**).

HOOKING UP THE POWER SUPPLY AND SPLITTING THE AC POWER TO THE SWITCH

Let's look at what we are powering, and what type of power each part uses. The four LED GU10 lights are powered by 110V and the fans and 10 mm blue LEDs get their power from the two 12V rails.

To simplify the operation of Ruby's Flame, we decided to use the cord from the ATX power supply and run that into a small electrical box we mounted inside our enclosure. This allowed us to splice into the 110V going to the power supply and use it to run the GU10 LED spotlights as well, so we only have one plug to power the whole prop.

It also allowed us to install a switch onto the side, so as Ruby danced by she could flick the switch with her foot or her hand to turn the entire prop on. (Basically, it's an off and on switch that activates all the lights and both fans

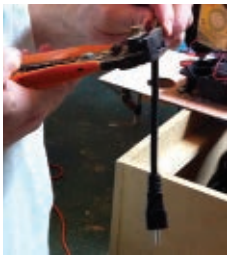


FIGURE 14. We cut about one foot off of the cord coming from the power supply and stripped the wires.

FIGURE 15A. This shows how we ran the wiring from the harnesses and the power supply into the electrical box knockouts.

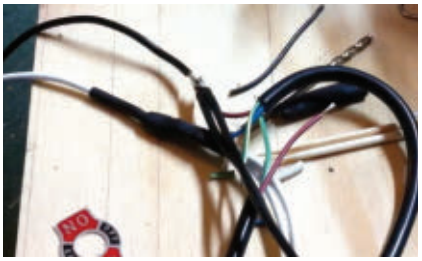


FIGURE 15B. Wiring the hot wires together with the black wire harnesses.

FIGURE 15C. Wiring the grounds together from the power supply cable.

at the exact same time to produce the flame effect.)

Take your hacked power supply and with the cover removed, drill some small holes in the bottom of the case. Be careful not to drill through anything but the case itself. Now, place the power supply inside of the enclosure (we have a lower shelf installed in ours to attach this to). The power supply needs to be securely mounted. We also need to place the electrical box inside the enclosure as far away as possible from the power supply. Set the electrical box aside for now.

We need to mount the power switch to the side of the enclosure. Since we're only going to have one power cord coming out of the prop, we cut the cord to the power supply about one foot from the plug end, stripped the wire back, and tinned all of it to prep for soldering (**Figure 14**).

We now need to run all the wiring into the electrical box so we can solder it all together. On the top and bottom of the electrical box are little knockouts. We'll need to remove these on one side and feed the cut ends from the power supply through one of the knockouts, then run the two black and white wires from the lighting harnesses through the other knockout and into the electrical box as shown (**Figures 15A, 15B,** and **15C**).

Next, take the white wires from the two light harnesses and solder them together with the two common wires: one from the plug end that we cut off and one from the cord running to the power supply. Shrink wrap all these wires once they are soldered. *(The common wire is the one coming from the wide spade on the power plug. Of course, not all power supply cords are the same and might have different colored wire for the common.)*

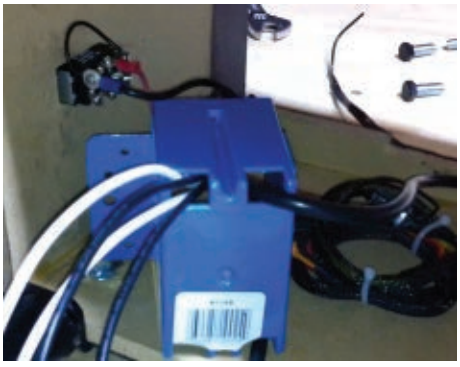


FIGURE 17. View of the electrical box before it is mounted inside the enclosure. Note that the electrical box will go over the switch to protect the wiring.

To connect the black wires from the lighting harness and hot wires together, we will make a pigtail. Cut a piece of black wire about three inches long and solder it together with the two black wires from the lighting harness and the hot wires from the power supply cord. Shrink wrap all of this together, leaving just the end of the new black wire hanging out; this is the pigtail.

FIGURE 16. Wiring for the switch.

The pigtail will need to have a terminal ring added by using crimpers, then crimping the ring to the wire. The ring will attach to the switch, so make sure the ring is the right size for the switch's screw.

So, now you should have three wires left; two of them are ground wires from the power supply cord. They can be soldered together and shrink wrapped since we won't be using them. The third wire from the plug end of the power supply cable will be used to connect to the switch. Attach a terminal ring to this wire (it should be the hot wire coming from the plug end that we cut from the power supply cord).

The switch we used is a double pull/double throw and has six screws on it. We will need to take a short piece of black wire (about two to three inches long) and use it as a jumper wire. This will connect to the two end screws so that when the switch is flipped in either direction, it will turn on the prop.

Attach the blue terminal ring from the black pigtail wire to one of the end screws, and attach the red terminal ring from the hot wire coming from the plug to the middle screw. All the wires will be attached on the same side. Do not attach any wires to the other side of the switch. It should look like **Figure 16** when wired correctly.

Be sure you make room for the switch! We did run into a problem here. The switch we picked did not have enough threads to go all the way through the side of our wood enclosure. This required us to notch out an area the size of the switch to recess it from the inside of the enclosure and have enough threads stick out to put the nut on to mount the switch.

When completed, the back of the switch should be inside the electrical box, and the power plug will hang down near the side of the enclosure.

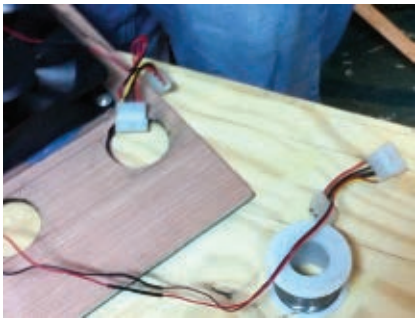


FIGURE 18. This photo shows how we added Molex connectors to the wires coming from the fans to be able to easily connect and disconnect them.

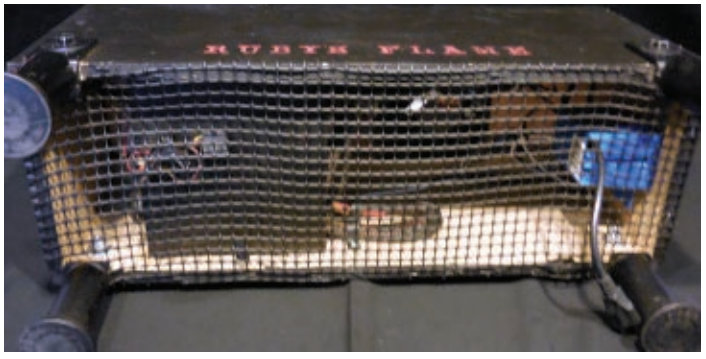


FIGURE 22. Buttoning it all up and installing the plastic hardware cloth.

SECURING WIRING, INSTALLING THE TOP PANEL, AND ADDING A NET

Before we put the top of the enclosure on and install the fans, you might want to tie up any loose cables and secure them. You will need to hook up the fans to the power supply at this point (**Figure 18**). We used some Molex connectors so we could easily detach the fans if needed. The fans usually will have one red and one black wire. You'll need to hook one yellow 12V wire from the power supply to the red wire on the fan, and one black wire from the power supply to the black wire on the fan. Place the panel onto the side rails, making sure you have the fans pointed in the right direction. Next, you'll want to mount the 10 mm LEDs into the panel. Ours fit snuggly, so we didn't use any glue.

We need to run the GU10 lighting sockets through all four corners of the panel (**Figure 19**). Take the PVC Els and run the socket through them (**Figure 20**), then connect one of the GU10 lights to it. Once you connect the light, it will sit in the PVC El and keep the wire from dropping back through the panel (**Figure 21**). Doing this with four of them was a bit tricky, as we do not want to mount the PVC Els to the panel just yet.

So, now all the wiring should be done; the fans should be hooked up; the 10 mm LEDs should be hooked up; and the harnesses should all be attached. We wanted to test it to make sure everything was done correctly, but before you plug it in be sure you don't have any wire near any of the fans. Once those start spinning, anything that gets sucked up can damage the fan.

We put a safety net on the bottom of our enclosure because we found out the hard way that a fan spinning at a zillion rotations a second can be stopped by a tiny piece of 5 mm Habotai silk (this is what we used as the cloth for the flame). We were testing the silk in the wind coming from the fans, and decided to stop and then start it flying again from a dead-stop position. We shut it off and the silk flame floated down to the top panel with just a bit of it hanging over the edge. We paused a few seconds and flipped the switch to turn it back on, but the silk got sucked up into the bottom of the enclosure. We heard the sound of plastic ricocheting and quickly shut it down. That silk flame had destroyed the fan; it took the blades right off of it while it was spinning.

So, with this in mind make sure to have something like plastic hardware cloth attached to the bottom (**Figure 22**). It won't keep everything out, but it will stop Ruby's Flame from getting up in the enclosure. We attached the cloth with screws and washers so if it was ever necessary to get inside to tweak something, it would be easy to do so. (Details on the material for the flame and making it are in the extended version of the article at the link.)

FINAL CHECKS

Make sure the switch is in the off position, and hook

FIGURE 19. This is a shot from under the top panel showing the GU10 LED light sockets in the corners and how the wires are run.

FIGURE 20. Inserting the GU10 socket through the PVC Els.

FIGURE 21. This shows how well the GU10 LED lights fit inside the PVC El.

FIGURE 24. Putting lighting gels cut to size into the LED lighting fixtures made out of the PVC Els.

FIGURE 23. Testing 1 .. 2 .. 3 .. success!! All the LEDs are lit and the fans are spinning!

A complete Parts List for all the different elements of this prop is available at the article link.

Other Resources

How to Convert a Power Supply Video Tutorial by Ramath Itol
www.youtube.com/watch?v=wWnS-SwFwrw&list=TLElfRxgf6qfz1xSLHLoVN4YPlsFo3PnTK

Ruby Joules official website — **www.RubyJoule.com**
The Jigglewatts Burlesque official website — **www.TheJigglewattsBurlesque.com**

Gothgloom
www.gothgloom.com
YouTube Channel — gothgloom

Ruby Joule Photo Credit: Photographer David de Lara

up the power cord to a power strip with a switch. This allows you to turn on the power from a safe distance until you verify all is good. If you hooked it up right, the fans should be spinning and all the LEDS should be lit up. Don't worry if the fans sound loud because they are loud; you are moving over 400 CFM of air (**Figure 23**).

ATTACHING THE LED SPOTLIGHTS

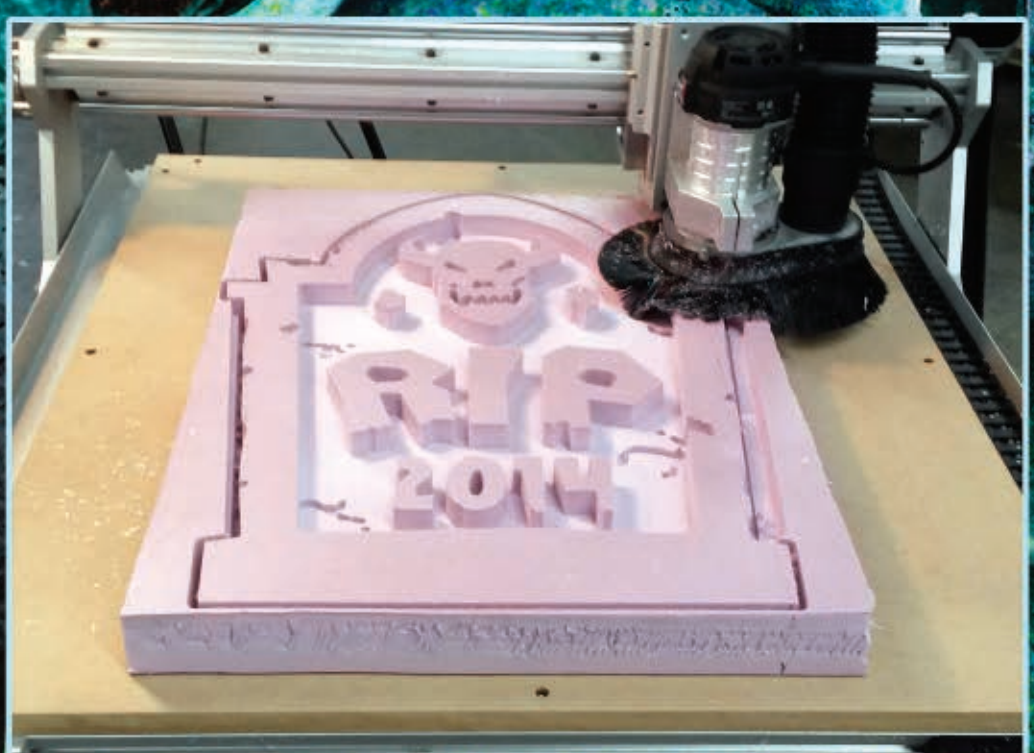
Now, it's time to aim the lights and secure them to the top. Since we're going for a flame effect here, we need to cut some gels. We used different shades of orange until we got the look we wanted. Cut the gels into little circles just smaller than the flanges; place the gel on top of the LED spotlight; and pop the flange on to hold the light and the gel in place (**Figure 24**). Now, take a couple pieces of Velcro™ and attach the silk to it. There should be a twist in the silk as it goes over the fans; this helps it to fly straight up and down.

Turn on the switch and the flame should start dancing. Keep you fingers away from the fan blades at all times! Adjust the lights so they shine properly on the flame; it's best to do this in a slightly darkened room so you can see the effect of the flame. Once you have the lights positioned where you want them, use silicone caulking or glue to attach the PVC Els in their proper place.

LIGHTS OUT ...

Turn off the lights, turn on the "fire," crank up some spooky tunes, and enjoy! Now, you've got your own Ruby's Flame! NV

What Do You Want on Your Tombstone?



Save Time and Money Making CNC Halloween Decorations

By Len Shelton and Melissa Shelton

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Shelton**.

Create complex 3D contoured parts by combining fast and simple 2.5D pocketing and profiling operations with manual finishing techniques.

When my friend, Vern asked me if I'd write an article for *Nuts & Volts* demonstrating how to create a Halloween decoration tombstone on a CNC router, I was psyched. I'm always looking for new and interesting ways to show off all you can do with CNC machines. So, I agreed to give it a shot.

Getting Started

As with any project, you have to do your research. I needed to answer questions like: What do tombstones look like? How are they shaped? What do they say on them? How are people using them in their Halloween displays? Most importantly: How do I make them on a CNC router? So, I got a lot of great design ideas examining epitaphs and tombstones using Google image search. Unfortunately, most of the models I found required 3D contouring. With that type of work, I would first need to spend the time creating a 3D model and even more hours carving it out.

There are three primary phases to a CNC project:

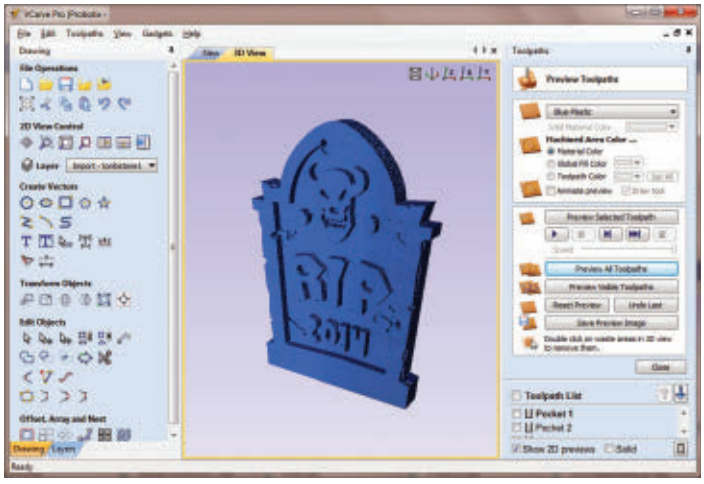
1) Design: The drawing or CAD model.
2) Tooling: Creating the tool paths with CAM software.
3) Machining: Running the tool paths on the machine.

I am admittedly an impatient man. With time being a finite resource we can never get back, isn't everyone looking for a faster way? So, let me show you how you can use CNC routers to shortcut the 3D contouring process. First and foremost, you want to create your basic shapes and features using 2.5D operations. This is by far the biggest time saver. I'm talking about pocketing, profiling, and drilling mainly flat features on flat parts. You then follow it up with a bit of hand sculpting. This marriage between CNC and hand work produces impressive results for this type of project, while shaving valuable time from the process.

To start, I needed an inexpensive material that I could get from my local home improvement store that was easy to work with. The obvious choice was 2" thick foam insulation which I purchased in a 4 x 8 foot sheet for about $28. It's thick enough to allow for a lot of depth and contrast in my design, which really pops when hit by a spot light on my lawn display. I happened to pick up a panel of pink Owens Corning — the one with the Pink Panther mascot (**Figure 1**). Other brands in other colors should work equally well.

FIGURE 1. Cuttingmy 2" foam stock.

FIGURE 2. 3D view of the tombstone design in VCarve Pro.



I Think I CAM, I Think I CAM ...

My favorite piece of CAM software is Vectric's VCarve Pro. This is by far the easiest-to-use CAM software on the planet. I also like how their software shows you a 3D preview of what the finished part will look like (**Figure 2**). I mention the CAM software first because the feature I like best is the built-in drawing tools, as opposed to other applications that require third-party drawing tools. This allows you to blend the first and second phases with a single piece of software.

Given that, we will skip the first phase and blend it in to the second phase when we get to that point.

DEFINITIONS

CNC: Computer Numerical Control. The automation of machine tools that are operated by precisely programmed commands encoded on a storage medium. Mechanical automation by use of computer commands.

CAM Software: The software that creates the tool paths for a CNC machine. It takes a 3D model or a 2D drawing as input and allows the user to choose machining operations for the various features of the model or drawing. The primary function of the CAM software is to calculate the tool paths by offsetting half the diameter of the tool from the final requested shape. The CAM software outputs the g-code required to run a CNC machine.

Vectors: Images defined by geometric shapes, points, lines, and curves, as opposed to bitmaps which are decribed by colors on a grid of pixels.

Boolean: Boolean operations on polygons are a set of Boolean operations (AND, OR, NOT, XOR ...) operating on one or more sets of polygons in computer graphics. These sets of operations are widely used in computer graphics, CAD, and in EDA (integrated circuit physical design and verification software).

Pocketing: Machine toolpath that plunges or spirals in and out of a pocket to cut a space such as those around a letter.

Profiling: Tooling operations that follow the outline of a shape.

Die Grinder: Pneumatic power tool for grinding, sanding, and polishing material.

This article is not intended to be a step-by-step tutorial, so I will not go into the details of how to use VCarve Pro. There are plenty of excellent tutorials and sample projects on their website if you need help using any of their software. You can download the design files for this project at the article link or at **www.probotix.com/downloads** to help get you started or if you want to simply recreate my design.

The first step in the CAM software is to define your stock (length, width, and height) and also where *you* want the origin (the zero location) to be. You can choose the back right corner at the bottom of the stock, top dead center, front left corner, or the top of the stock — it's wherever you need it to be. It can depend on a lot of things, but typically people use the front left corner at the top of the stock.

The next step is to import your drawing from another drawing program. In this case, you can take advantage of Vcarve's built-in drawing tools to create your shapes. I design machines and electronics for a living, so mechanical design comes naturally to me. However, I really struggle with organic design. So, whenever I come across a project like this, I rely on a variety of resources to help me.

Design, Fonts, and Clipart

There are plenty of sources of clipart available online, but many of them are click farms in disguise, so beware. I really like the CD-ROM/DVD clipart collections that include categorized catalogs (long live print!). Most of these designs require a lot of cleanup before they can be machined. They were not designed for CNC and will often have both disconnected and hidden vectors that have to be reworked first. Boolean drawing tools are your friend here.

Another great source of simple shapes are themed dingbat fonts. They require very little work to make them machinable. The horned head in my design was one of the "letters" in such a font. Speaking of fonts, there are tons of free font websites out there where you can find a multitude of themed type styles for your designs.

Once you are satisfied with your design, you will assign tool paths to the various shapes in it. Vcarve has a variety of tool path operations, but for this project we are only using the pocketing and profiling operations. With any of the tool path operations, you will be assigning the tool geometry, starting depth, depth of cut, step-over, feed rate, plunge rate, direction of cut, and so on. Because I was working with foam, I was able to take some overly aggressive cuts.

The order of operations is important when laying out your tool paths. For instance, you may need to cut your shallower pockets first when you have overlapping or embedded pockets. If the stock is being held from the outer edges, the last operation should be to do your final

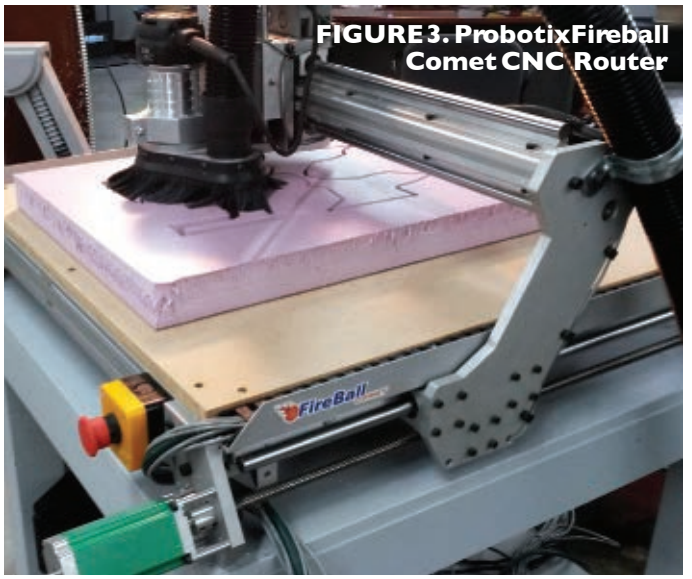


FIGURE 3. ProbotixFireball Comet CNC Router

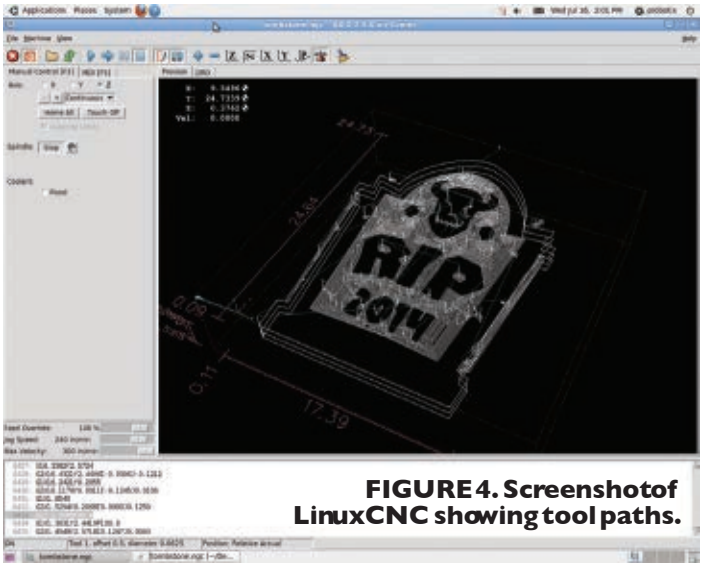


FIGURE 4. Screenshotof LinuxCNC showing tool paths.

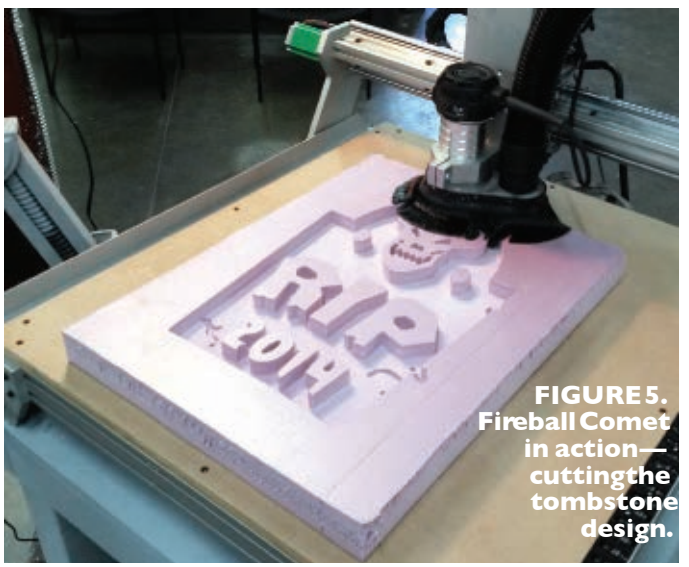


FIGURE 5. Fireball Comet in action—cuttingthe tombstone design.

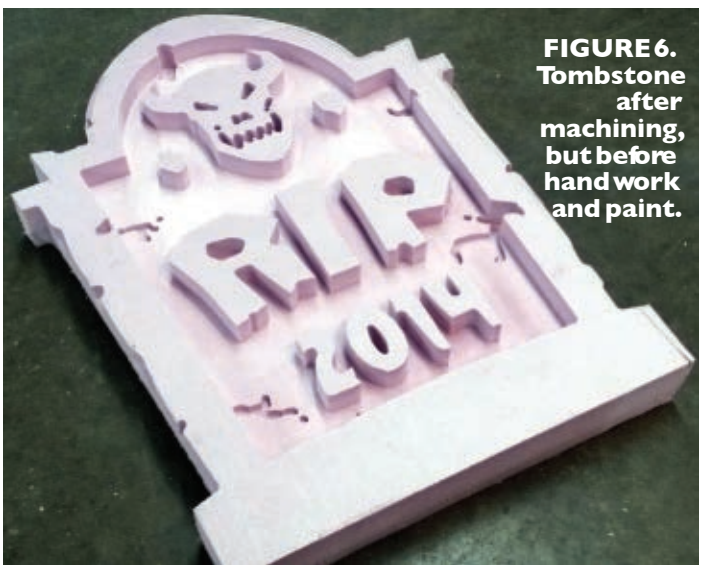


FIGURE 6. Tombstone after machining, but before hand work and paint.

outside profile pass. I didn't have an end mill long enough to make it through the whole slab of 2" foam, so on my outside profile, I cut it through as far as I could, then hand cut the rest of the way through with a knife.

Now that you have your tool paths, you export them as g-code through the appropriate post-processor, and then carry that g-code over to the CNC machine on a USB thumb drive and load it into the control software. Our machines at Probotix run the open source software LinuxCNC.

Mount Up

I was cutting this particular part on the Probotix FireBall Comet™ CNC router that has a 25" x 25" work envelope (**Figure 3**). My foam slab was 18" x 24", so I had to be careful that I mounted it to the table inside of the travel envelope of the machine. Double-sided 3M tape that has the green argyle backing is what I like to use for mounting stock to my table. Use a generous amount so the stock doesn't come loose in the middle of the job.

Once the stock is mounted, install the tool into the spindle and then jog the tool over to the corner that you chose for the origin in the CAM software. Then, you will "touch off" each axis. What you are doing is telling the control software that you are now sitting at the starting point of each axis, or X0 Y0 Z0.

Give yourself a sanity check and look at the 3D tool path on the display. You want to make sure that the tool path appears where you think it should within the work envelope bounding box on the screen (**Figure 4**). Then, hit the start button, sit back, and watch (**Figure 5**).

About 30 minutes later, you will have the basic tombstone carved out. So, pry it off the table and remove the double-sided tape. **Figure 6** shows what it looked like after I cut off the outside scrap. Pretty cool already,

FIGURE 7. Die grinder, hand file, sand disc, and caulk.

FIGURE 9. Finished tombstone decoration.

but not very scary looking ... yet.

The next step is to hand contour the piece to rough it up so it looks aged and weathered. There are many tools and methods you could use here, and you could spend a lot of time adding detail. Remember how impatient I am, though? I grabbed a die grinder with a rasp bit and a sanding wheel. I also used a hand rasp, and then smoothed out certain parts of the tombstone with some DAP fast drying latex caulk (**Figure 7**). Watch out for that die grinder — you can remove too much material in a hurry if you are not careful.

FIGURE 8. Painting supplies and brushes.

Finishing Touches

So far, so good, but have you ever seen a pink tombstone? Me neither. So, let's change its color!

I love modern spray paint technology. There are many fast-drying exotic finishes available — your options are limitless. You can get a fantastic finish with little time and effort. A fleck stone spray paint finish was very tempting here, but since most spray paints will dissolve foam, I decided to use latex. I chose a satin gray as my base coat, and then used gray, black, and burnt umber mixes to weather and shade the tombstone (**Figure 8**).

Save Time, Save Money

You can spend a little time or a lot of time here. These tombstones are typically viewed under low light conditions, so I was looking mostly for contrast and depth, and that didn't require a lot of time. Here is a breakdown of the time invested in this project:

- Research: 3 hours
- Design time: 1 hour
- CNC routing: 30 minutes
- Hand contouring: 10 minutes
- Painting: 30 minutes

So, my total time was 5:10.

RESOURCES

Probotix Comet CNC Router
www.probotix.com

Royalty Free and Public Domain bitmap and vector clipart libraries
www.openclipart.org
www.pdclipart.org
www.clker.com

Files for this project
www.probotix.com/downloads

LinuxCNC
www.linuxcnc.org

Vectric Vcarve Pro
www.vectric.com

Free Fonts
www.dafont.com

Halloween Fonts
www.dafont.com/theme.php?cat=803

How to draw a creepy tombstone
www.fuelyourillustration.com/draw-a-creepy-tombstone-using-adobe-illustrator/

Some definitions sourced from WikiPedia and other online resources

Tombstonein Halloween lawn display.

Compare that to the 10-20 hours that could easily be spent on a full CNC 3D contouring to accomplish the same thing (**Figure 9**)!

Ta-Da!

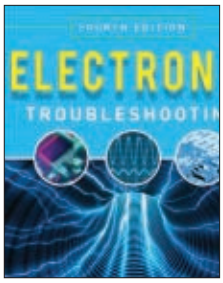
All-in-all, I was pretty satisfied with the results from such a small investment in time. If I were going to do this again, I would have spent more time and creativity on the tombstone verbiage.

Do a Google search for "funny epitaphs" to get some inspiration. Maybe include names of family members or friends. Add an Arduino and LED lights. Then, make a whole graveyard full of them if you want!

Most importantly, make sure to work safe and have fun! **NV**

GREAT FOR DIYers!

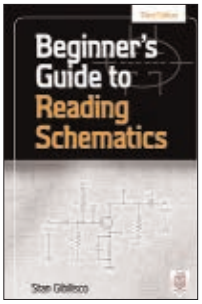
Electronic Troubleshooting, Fourth Edition
by Daniel Tomal, Aram Agajanian



Electronic Troubleshooting, Fourth Edition provides technicians with a wealth of problem-solving methods and information on troubleshooting theory, techniques, and practices for a wide variety of electrical and electronic devices. Special emphasis is placed on the digital electronics and microprocessor-based systems that are used in today's industrial and personal applications.

Regular Price $70.00
Sale Price $59.95

Beginner's Guide to Reading Schematics, 3E
by Stan Gibilisco



Navigate the roadmaps of simple electronic circuits and complex systems with help from an experienced engineer. With all-new art and demo circuits you can build, this hands-on, illustrated guide explains how to understand and create high-precision electronics diagrams. Find out how to identify parts and connections, decipher element ratings, and apply diagram-based information in your own projects.

$25.00

Make Your Own PCBs with EAGLE
by Eric Kleinert

Featuring detailed illustrations and step-by-step instructions, *Make Your Own PCBs with EAGLE* leads you through the process of designing a schematic and transforming it into a PCB layout. You'll then move on to fabrication via the generation of standard Gerber files for submission to a PCB manufacturing service. This practical guide offers an accessible, logical way to learn EAGLE and start producing PCBs as quickly as possible.

$30.00

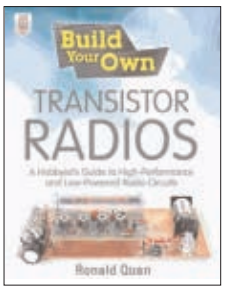
Programming the BeagleBone Black: Getting Started with JavaScript and BoneScript
by Simon Monk

Learn how to program the BeagleBone Black — the wildly popular single-board computer — using JavaScript and the native BoneScript language. You'll find out how to interface with expansion capes to add capabilities to the basic board, and how to create a Web interface for BBB. Two hardware projects demonstrate how to use the board as an embedded platform.

$15.00

Build Your Own Transistor Radios
by Ronald Quan

A Hobbyist's Guide to High Performance and Low-Powered Radio Circuits



Create sophisticated transistor radios that are inexpensive yet highly efficient. Inside this book, it offers complete projects with detailed schematics and insights on how the radios were designed. Learn how to choose components, construct the different types of radios, and troubleshoot your work.

***Paperback, 496 pages**
$49.95

The Steampunk Adventurer's Guide
by Thomas Willeford

Steampunk stalwart Thomas Willeford cordially invites you on an adventure — one in which you get to build ingenious devices of your own! Lavishly illustrated by award-winning cartoonist Phil Foglio, *The Steampunk Adventurer's Guide: Contraptions, Creations, and Curiosities Anyone Can Make* presents 10 intriguing projects ideal for makers of all ages and skill levels, woven into an epic tale of mystery and pursuit.

Regular Price $25.00
Sale Price $19.95

How to Diagnose and Fix Everything Electronic
by Michael Jay Geier

Master the Art of Electronics Repair

In this hands-on guide, a lifelong electronics repair guru shares his tested techniques and invaluable insights. *How to Diagnose and Fix Everything Electronic* shows you how to repair and extend the life of all kinds of solid-state devices, from modern digital gadgetry to cherished analog products of yesteryear.

$24.95

Programming PICs in Basic
by Chuck Hellebuyck

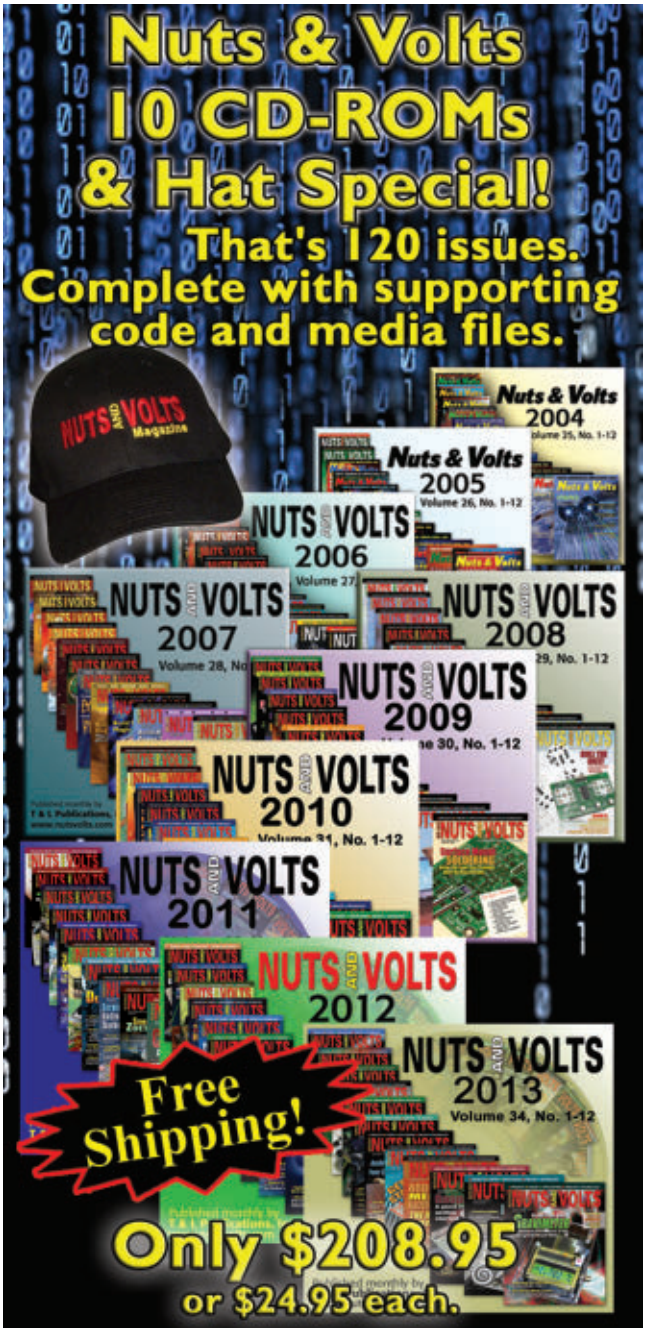
If you wanted to learn how to program microcontrollers, then you've found the right book! Microchip PIC microcontrollers are being designed into electronics throughout the world and none is more popular than the eight-pin version. Now the home hobbyist can create projects with these little microcontrollers using a low cost development tool called the CHIPAXE system and the Basic software language. Chuck Hellebuyck introduces how to use this development setup to build useful projects with an eight-pin PIC12F683 microcontroller. **$14.95**

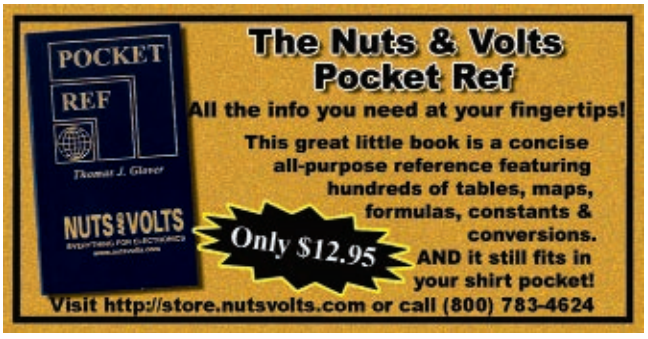
Programming Arduino Next Steps: Going Further with Sketches
by Simon Monk

In this practical guide, electronics guru Simon Monk takes you under the hood of Arduino and reveals professional programming secrets. Also shows you how to use interrupts, manage memory, program for the Internet, maximize serial communications, perform digital signal processing, and much more. All of the 75+ example sketches featured in the book are available for download. **$20.00**

EDUCATIONAL

CD-ROM SPECIAL





PROJECTS

Fading Eyes Deluxe Board

The fading eyes circuit gives you two LED eyes that can be adjusted between a slow fade-in/fade-out to quick pulses. The speed is changed by simply adjusting the variable resistor with a small screwdriver. Another adjustment allows you to set how long the LED stays on within the on/off fade cycle. Includes a battery snap, two red LEDs, and two 24 inch eye cables.

$15.95

Talking Skull Kit

Now back in the NV Webstore — the new and improved Talking Skull Kit. The new kit includes the much improved audio/servo driver board. See all the details online. This kit provides all the necessary supplies to build one talking skull. You provide the labor and tools, and you'll have a great Halloween prop in no time!

$97.95

Solar Charge Controller Kit 2.0

Now with more options!
If you charge batteries using solar panels, then you can't afford not to have them protected from over-charging. This 12 volt/12 amp charge controller is great protection for the money. It is simple to build, ideal for the novice, and no special tools are needed other than a soldering iron and a 9/64" drill!

$27.95

Geiger Counter Kit

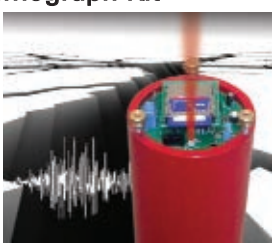
As seen in the March 2013 issue

This kit is a great project for high school and university students. The unit detects and displays levels of radiation, and can detect and display dosage levels as low as one micro-roentgen/hr. The LND712 tube in our kit is capable of measuring alpha, beta, and gamma particles.

Partial kits also available.

$145.95

Seismograph Kit

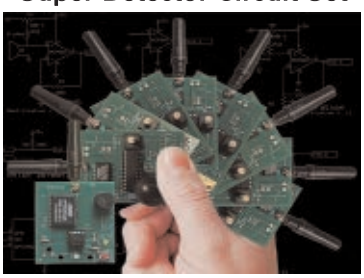


As seen in the May 2012 issue
Now you can record your own shaking, rattling, and rolling.

The Poor Man's Seismograph is a great project /device to record any movement in an area where you normally shouldn't have any. The kit includes everything needed to build the seismograph. All you need is your PC, SD card, and to download the free software to view the seismic event graph.

$79.95

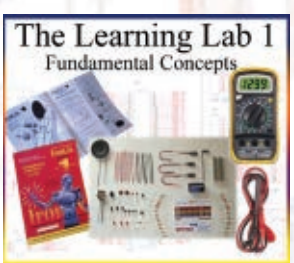
Super Detector Circuit Set



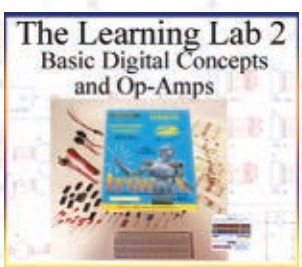
Pick a circuit!
With one PCB you have the option of detecting wirelessly: temperature, vibration, light, sound, motion, normally open switch, normally closed switch, any varying resistor input, voltage input, mA input, and tilt, just to name a few.

$32.95

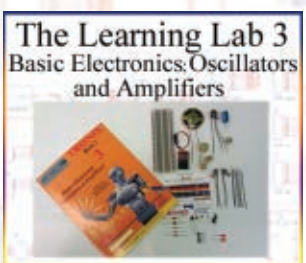
FOR BEGINNER GEEKS!



$59.95



$49.95



$39.95

The labs in this series — from GSS Tech Ed — show simple and interesting experiments and lessons, all done on a solderless circuit board. As you do each experiment, you learn how basic components work in a circuit, and continue to build your arsenal of knowledge with each successive experiment.

For more info and a promotional video, please visit our webstore.

The Crypt Creature

By Maurice Cedeno

Post comments on this article and find any associated files and/or downloads at **www.nutsvolts.com/index.php?/magazine/article/september2014_Cedeno**.

The Crypt Creature is an animated six foot tall replica of a stone block burial crypt with black bars in front. Inside, a crouched cowled figure grips the bars with its skeletal hands, its head hanging down (Figure 1). When activated, the creature lets out a loud growl, lunges forward, and forces the bars open. Its head snaps up revealing its skeletal gaze while emitting a shrieking scream (Figure 2). It then bellows "Happy Halloween!" in a deep sinister voice. After a brief pause, the creature begins laughing as it retreats to its original position safely back behind the bars with its head moving to once again stare down at the ground.

I created the Crypt Creature prop for my home haunt in Orange County, NY that I call "Mountainview Cemetery." My interest in Halloween and scaring people started early in life. Growing up, I shared a room with my brother, Marcel (we're identical twins). At the age of nine, we turned our room into a haunted house and got a kick out of showing it to friends and family. As teenagers, we constantly scared each other with different pranks.

The fun I had as a kid at Halloween has stuck with me. Now, at the age of 40, I've really started getting into building Halloween props.

FIGURE 1. Crypt Creature waiting for activation.

FIGURE 2. Crypt Creature after activation.

Internet Inspiration

It was early fall a few years ago, when a simple marionette prop known as the Flying Crank Ghost (see the Haunting 101 article in this issue for a description) caught my attention and I decided to build one. Even though it took a while to find all the pieces (and the time to put them together!), when I finished it and switched it on for the first time, I was floored! This was such a simple build but it provided such an amazingly spooky

FIGURE 3. The cordless power drill that drives all the animations.

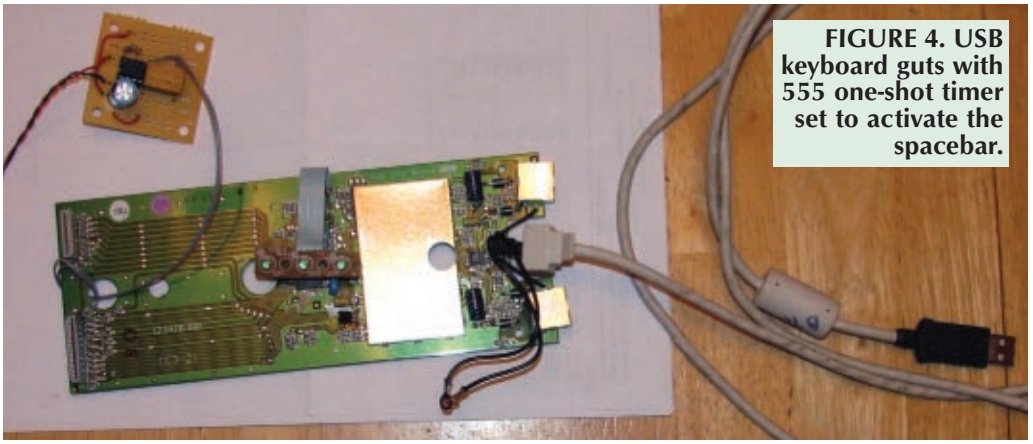


FIGURE 4. USB keyboard guts with 555 one-shot timer set to activate the spacebar.

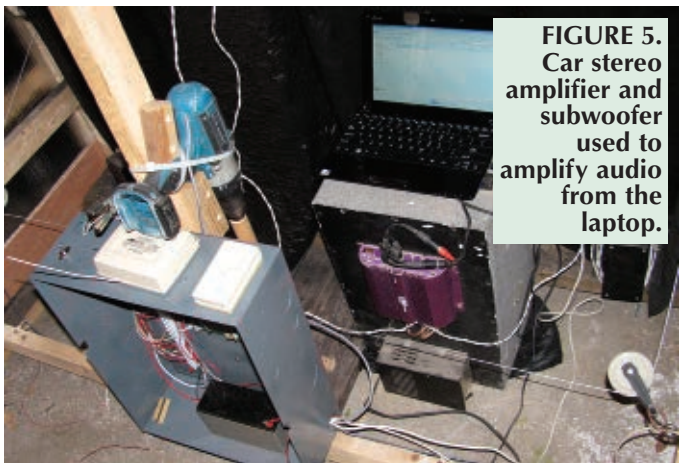


FIGURE 5. Car stereo amplifier and subwoofer used to amplify audio from the laptop.

FIGURE 6. The animated toy that inspired this build.

Crypt Creature in Action
http://youtu.be/9V2UtTA2lBI

Making of the Crypt Creature
http://youtu.be/AHAAcS1Z0RY

prop! I decided I needed to build more. With just three weeks left until Halloween and with a successful Flying Crank Ghost build under my belt, I started looking at the leftover parts on my workbench and went to town. As a result, my very first home haunt debuted with my Flying Crank Ghost and *three* additional motion activated props. I was well on my way to creating my favorite and most elaborate prop to date: the Crypt Creature. My philosophy for building props is, "Use what you have first, then buy only what you need." So, the Crypt Creature is animated by a hacked cordless drill I had laying around (**Figure 3**), and the sound effects were made using a surplus laptop that was triggered by the guts of an old USB keyboard (**Figure 4**). The sounds were amplified through an old car stereo amplifier and speaker system. The entire system was powered by a 12V 18 Ahr battery, and triggered with a salvaged wireless remote (**Figure 5**).

Toying with an Idea

The idea for this prop came from a small battery powered Halloween toy I found at a local drug store. The toy was a six inch figure of a prison-garbed skeleton in a cage (**Figure 6**). When its rudimentary motion detector was triggered, it lurched forward, spread the plastic bars of its cage, and said something rather corny through its tinny sounding little speaker. However, when I first walked past this thing, it actually startled me!

I think it was the combination of the interesting motions and well-timed sounds. It really got me wondering how hard it would be to scale it up for a life-sized effect. Could I turn the little toy into a big scare? Finding out became my obsession.

Getting Ahead

To inspire myself when making Halloween props, I always start with a scary head or mask; it helps to get my creativity going. For this prop, I found a witch-like full head skeleton mask that was very creepy. I sat it on a post in my garage/workshop and would look at it every time I came in, imagining how it would move. The idea was to start with the head hanging down and then raise it up to startle people just like the little six inch toy had startled me. Once I imagined the neck moving forward and the top of the head being held back with a string, I knew I had it! The rest of the mechanism just seemed to fall into place after that.

One of the most interesting things about this build was just how many motions could be accomplished using only a *single motor*. The mechanism began with a wooden 1 x 6 acting as a base. To that, I attached a 1 x 3 plank standing vertically in the front to hold the creature, and another in the back to hold the winch rod (**Figure 7**). On the front vertical plank, I used a single bolt to attach a second plank that could pivot forward and backward. This was to act as the creature's torso, and the single pivot point would allow for the lunging motion. To the top of this torso plank I attached the head with a neck swivel joint to allow the head to move freely. I also attached a string from the back of the head to the rear vertical plank.

FIGURE 7. The base board and two vertical planks that hold the torso and the winch rod.

FIGURE 8. The bottom of the winch rod that anchors all the cables and drives their motion.

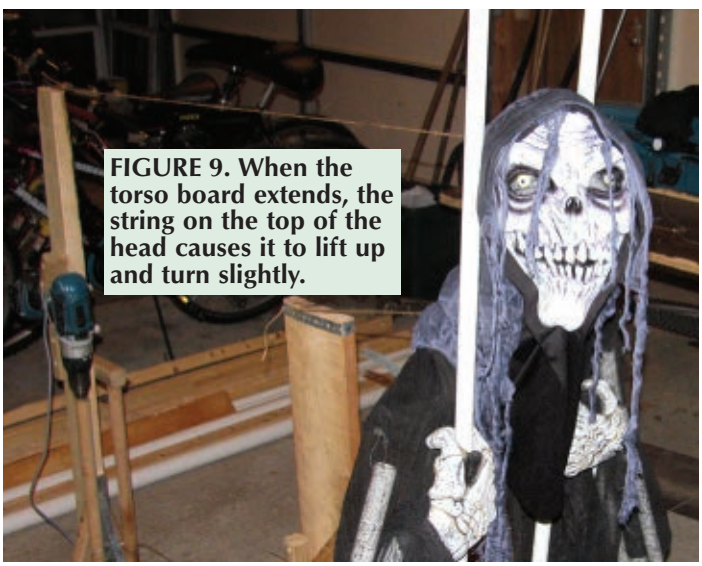


FIGURE 9. When the torso board extends, the string on the top of the head causes it to lift up and turn slightly.

FIGURE 10. The two arms are attached by the hands to the two PVC pipe bars.

Next, I ran a cable from the vertical winch rod forward towards the front support where I pinned it to the torso plank. It then ran around two rollers at the front of the prop and returned to the back of the prop where it went around a third roller before returning to the first vertical winch rod (**Figure 8**). When the drill spins clockwise, the cable pulls the plank backwards at the bottom which makes the torso lunge forward. As the torso moves forward, the head is pulled upwards by the string that anchors it to the rear plank (**Figure 9**). When the drill spins counter-clockwise, it pulls the torso board back to its starting position.

I made two PVC pipe arms and attached them to two PVC bars that would be used as the cage bars (**Figure 10**). Two block-and-tackle type pulley systems were used with cables that went through the arms and hands. This pulley system decreased the force needed to open the bars and decreased the bar travel from nine inches to four inches (**Figure 11**).

ELECTRIFYING MOTION

To control the motor, lights, and

FIGURE 11. Top view of the left arm pulley system.

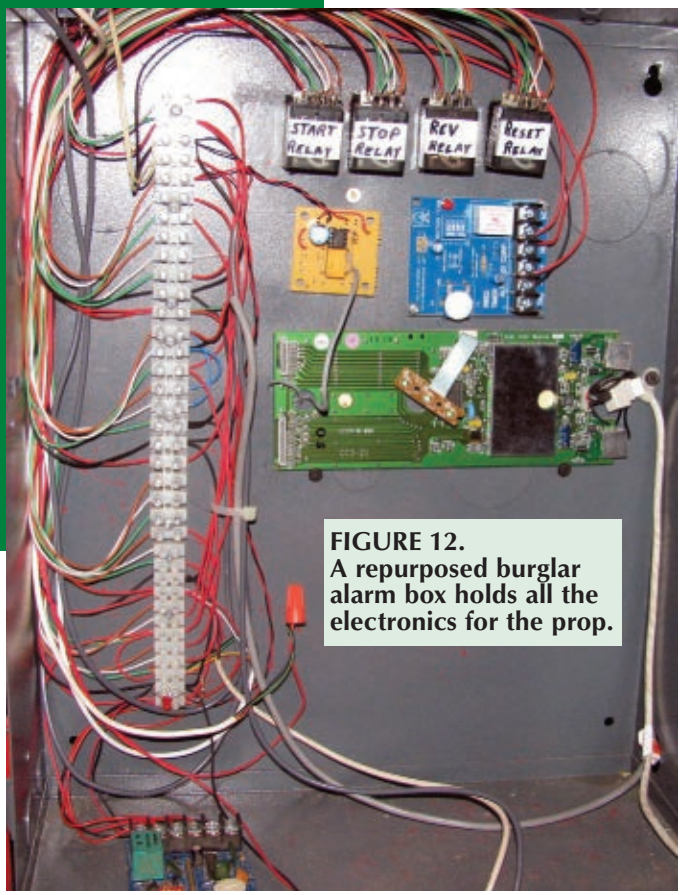


FIGURE 12.
A repurposed burglar alarm box holds all the electronics for the prop.

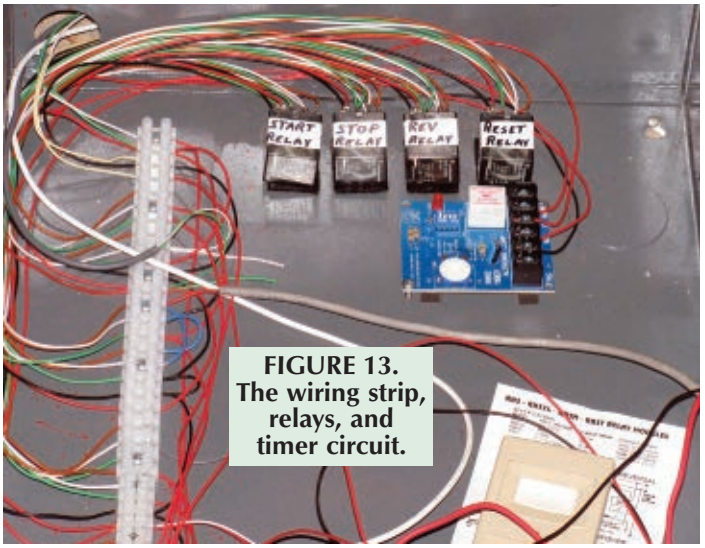


FIGURE 13.
The wiring strip, relays, and timer circuit.

sounds, I made a controller and housed it in a gutted metal alarm system cabinet (**Figure 12**). The controller used four DPDT relays, three timers, the guts from a USB keyboard, and a momentary type dry contact RF wireless remote control. The relays and timers are used to start, pause, and then reset the prop, as well as control sound effects and lights (**Figure 13**). The start relay is wired in a self-latching configuration by having one set of contacts used to apply power to its own coil. The other contacts of the start relay apply power to the motor circuit and the crypt lighting, as well as triggering the one-shot 555 timer circuit that causes one close/open cycle of its output.

Once triggered by the wireless remote, this relay stays energized until power to it is interrupted. This keeps the torso moving forward until it is extended all the way and activates a position sensor that cuts power to the latching relay (thereby resetting it). This also triggers the "delay timer" to keep the creature visible for a few seconds.

At the end of the delay, the timer activates the "reversing relay" which starts the prop moving backwards. Once the prop is all the way back to the reset position, a second position sensor activates the "reset relay" that cuts power to the latching relay which shuts off the prop motor and the lights.

Sounds for the prop were created with a sound editor, and a sound effects file was saved to the laptop. To play the sound file, I used the built-in "media player" bundled with the OS. Each time the spacebar is pressed, the sound file plays one time and then stops. I used a 555 chip to create a one-shot timer (**Figure 14**) to short the terminals of the spacebar on the innards of the hacked USB keyboard (**Figure 15**). The one-shot timer is activated by the latching relay. This started the sound effects as soon as the prop started moving, which had the added benefit of covering the sound of the drill motor running.

Crafting a Crypt

The crypt itself was modeled after a local style I'd seen on my way to work. The structure is a wood frame (**Figure 16**) sheathed in 3/4 inch Styrofoam sheets with PVC bars instead of a door. I spent time carving the foam to make it appear as if it were made of stacked granite blocks. This obsession of mine also became my brothers, as we worked at a feverish pace to get the prop done for Halloween that year.

Late one night with just one day left before the big night, we were doing a

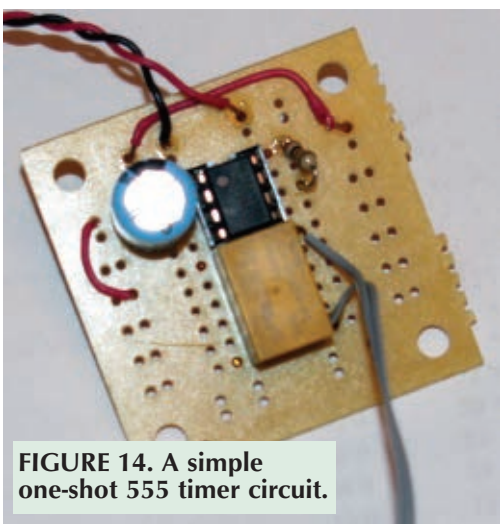


FIGURE 14. A simple one-shot 555 timer circuit.

FIGURE 15. The 555 timer connected to the USB keyboard.

TIMERS

I used Altronix Corp 6062s as I had a few of them in my junk box: **www.altronix.com/products/product.php?name=6062**.

These are industrial strength timers typically used for alarm systems and industrial automation. For this application, they're definitely overkill. A cheaper alternative would be the 555 timer kit from Velleman available at: **www.parts-express.com/velleman-k2579-universal-start-stop-timer-kit--320-184**. This Velleman part can be used to replace the 6062s and the custom 555 timer I built from scratch.

REMOTE

I used a garage door opener remote from my junkbox, but if you don't happen to have one laying around, All Electronnics has a workable remote: **www.allelectronics.com/make-a-store/item/rc-10/keychain-remote-control-12vdc-6-amp/1.html**.

RELAYS

You can pick up relays on many surplus sites. Some suitable candidates for this project include:

www.allelectronics.com/make-a-store/item/rly-2012/12-vdc-d.p.d.t.-10-amp-relay/1.html
www.mpja.com/12VDC-DPDT-20A-Aromat-Relay/productinfo/18610%20RL
www.goldmine-elec-products.com/prodinfo.asp?number=G19820

POWER

For portability and simplicity, I ran this prop on a 12V battery. If you prefer to run on 110 VAC, some suitable candidates for power are:
www.allelectronics.com/make-a-store/item/ps-1241/12vdc-4.16a-power-supply/1.html
www.allelectronics.com/make-a-store/item/ps-1262/12-vdc-5-amp-power-supply/1.html

AUDIO

Once again, I hit my junkbox for the audio, but if you don't have an extra power amp laying around, check these out:
www.allelectronics.com/make-a-store/item/amp-15/stereo-amplifier-20w/channel/1.html
www.parts-express.com/tda7492-digital-audio-amplifier-board-2x50w--320-606

Parts List

bit of testing when disaster struck. We triggered the prop and it proceeded to lunge forward, but it didn't stop! Imagine the horror on our faces as we watched the prop try to pull itself apart. We heard the sound of springs stretching and parts breaking as the side walls were being pulled together. I ran to the back of the crypt, frantically yanking the power to the controller. Shaking our heads, we looked at each other in disbelief. Turns out the sensor that told the motor to stop had failed. The foam walls and PVC pipe frame were no match for the power of the drill.

We took the sides off the crypt and assessed the damage. Lucky for us, the flexible nature of our building materials saved the prop from serious issues. One cable had broken, there were a few cracks in the foam walls, and the frame had come a bit loose in places. Other than that, the prop was surprisingly intact.

We were able to patch the few cracks and reattach the cables, then double-check the sensors. In short order, we had the creature back in business! I have to hand it to my brother. If it wasn't for all his donations to the project and staying up until the wee hours in the morning after this failure, the prop would never have been finished for Halloween 2010. The prop did debut the next day to scare quite a few people (**Figure 17**) but with one little change: a kill switch in the front! NV

FIGURE 16. The wooden frame for the crypt taking shape.

FIGURE 17. The crypt in place and ready to scare for the Halloween season!

READER-TO-READER TECHFORUM

All New TECHFORUM Online At www.nutsvolts.com/tech-forum

>>> QUESTIONS

Antenna Preamp

Is there a CMOS op-amp with low noise, good common-mode isolation, and unbalanced output available? I would like to use it in a loop antenna preamp in a location that has an extremely high power-line noise level.

E-mode whips with a preamp are definitely unusable. This antenna would be untuned and intended for use below 30 MHz.

#9141 John R. Seeley KI4LTB
Palm Bay, FL

UV LED VS UV Bulb

I'm been working a lot with high power LEDs now that they're so affordable. I'm especially fond of the UV LEDs for visual effects at night, but I've heard that some UV LEDs can cause blindness, and that I should use a UV bulb to create the effects. Is this true? Can someone explain the difference?

#9142 Nick Robbins
Ft Wayne, IN

Noise Cancelling

Is there such a thing as a noise cancelling technology that would allow me to play my guitar without disturbing the neighbors?

I get complaints about noise from my apartment when I play. I just can't use headphones and I've tried putting blankets on the wall for soundproofing, but I still get complaints. How about an electronic solution?

#9143 Brian Tate
Madison, WI

>>> ANSWERS

[#7143 - July 2014]
Lithium Charging

I'm thinking of building a solar charger for my iPhone, but don't know how to handle the internal lithium battery in terms of taper current, etc. – especially when I have the phone on all day. What I've found online is information on charging disconnected lithium batteries, not ones under load. Any hints?

#1 Charging your iPhone should not require any special accommodations. The OEM charger from Apple supplies 5V at 1A via a USB connection with proper cable. Either the 30-pin connector or the new five-pin "lightning" connector cable both deliver the same power.

The phone (as all phones now) has built-in current limiting, temperature sensing, and voltage sensing to protect the battery.

You just need to deliver 5V regulated to the cable with, of course, polarity protection for the solar charger. A simple LM7805 regulator IC is what most chargers use for the 5V.

It really is NOT a good practice to leave the phone on the charger continually, as most rechargable batteries 'like' to be exercised. Charge it up, let it run off the battery until it shows recharge is needed, then reconnect the charger. You should get several years of service from it.

Rod Hogg
REVCOM Electronics
Scott City, KS

#2 First, under load shouldn't be that much different from being off as long as the circuit can handle the current needed to do both jobs. That you will need to measure and then find a pre-built circuit to do the trick.

I suggest pre-built since they are so cheap. I did the same kind of thing for a phone that refused to recognize its own charger as a valid charger. A good 'ol Motorola phone; I'll never buy another phone that has some type of recognition routine in it to check the charger.

In any event, the first thing I noticed was that my camera charger was for the same type of battery, same voltage, same Ahr rating, same Li Ion battery. I hooked up wires from the charger into the phone and it worked just fine.

Next, I wanted a more universal Li-Ion battery charger and found more than one online. The one I settled on was from **dx.com**:

1A Lithium battery charging module - blue $1.70/e
http://dx.com/p/1a-lithium-battery-charging-module-blue-205188

There are others as well;
a red module at 3A for under $9
http://dx.com/p/1a-lithium-battery-charging-module-red-318740

These are circuit cards usually with a USB power port to give it 5V/1A to work with, so you will need to do some soldering for connections to the battery from the board.

Send all questions and answers by email to **forum@nutsvolts.com** or via the online form at **www.nutsvolts.com/tech-forum**

All questions *AND* answers are submitted by *Nuts & Volts* readers and are intended to promote the exchange of ideas and provide assistance for solving technical problems. All submissions are subject to editing and will be published on a space available basis if deemed suitable by the publisher. Answers are submitted by readers and **NO GUARANTEES WHATSOEVER** are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals.

Always use common sense and good judgment!

Send all questions and answers by email to **forum@nutsvolts.com** or via the online form at **www.nutsvolts.com/tech-forum**

At 1A, expect to charge and run your phone without a problem since most cell phones — even on transmit — are below 1W output. Refer to: **https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health** and **http://hypertextbook.com/facts/2006/EbruBek.shtml**.

Phil Karras KE3FL
via email

[#8141 - August 2014]
Audio Mixer Question

I have a rather old audio mixer that has 1/4" inputs for microphones. The inputs are labeled "HiZ." I have microphones I'd like to use, but they have a three-pin "XLR" style connector. Do I need some kind of matching transformer, or can I just use a 1/4" male plug wired to some of the contacts on the XLR jack?

#1 For starter, you CANNOT use a 1/4" male plug wired to an XLR jack. The 1/4" line is unbalanced, meaning there is one signal line and a ground. The XLR line has two signal lines with opposite and equal signals plus the ground. Use a RadioShack model 274-016 (or equivalent) A3F XLR jack to 1/4" plug adapter. This adapter contains a balance-to-unbalance (balun) transformer to match the two lines properly. The balanced line and High Impedance (HiZ) are both used to reduce interference on low level signal lines like microphones.

Tim Brown PhD EE, PE
Honea Path, SC

#2 Yes. You need an adapter to mate that "unbalanced" (Hi-Z) microphone input to a "balanced" (Low-Z) microphone. Here are three ideas:

RadioShack sells item #274-016 (you'll need cables to connect the two ends). Here's the link: **www.radioshack.com/product/index.jsp?productId=2062443**. Chances are your local Shack has it in stock.

Parts Express (**www.partsexpress.com**) sells a similar adapter: **www.parts-express.com/pyle-ppmjl15-1-4-male-to-xlr-female-mic-cable-15-ft--248-4614**.

If you're handy with a soldering iron, here's a DIY idea: **www.media-college.com/audio/connection/xlr-jack-mono.html** (all necessary parts are available at RadioShack).

All three methods will do what you need — just pick the option that's easiest for you to implement.

Ken Simmons
Auburn, WA

[#8142 - August 2014]
Help Identifying an Old Robot

I picked up an old robot chassis at an estate sale for $25. I have taken some pictures in the hope someone might be able to identify the make/model for me.

I am SO jealous! That is the RB5X robot made by RB Robotics in 1982. You can read more about this awesome robot on my website at **www.robotsandcomputers.com/robots/rb5x.htm** or at this other great site at **www.theoldrobots.com/rb5x.html**. I hope you enjoy your very impressive find! I'm still looking for one of my own.

Derek Tombrello
via email

[#8143 - August 2014]
iPod Battery Reconditioning

My son has gifted me with his cast-off iPod Classic 30 gb player. Unfortunately, the battery life is only about 15-20 minutes of playing before it goes dead. Does anyone know of a way to recondition the battery?

#1 Forget the old battery and buy a new Lenmar replacement battery for the iPod Classic 5 G (30 Gb) This battery replaces 616-0230 and EC008-2. Amazon carries them for around $15. The Portable Rechargeable Battery Association (PRBA) highly recommends against using reconditioned lithium-ion batteries, and I would assume this also applies to lithium-polymer batteries due to their propensity for catching fire. I found one website that advocated a repeated freeze and charge process, but for $15 I would buy a new known battery versus trying to resurrect a possibly defective unit.

Tim Brown PhD EE, PE
Honea Path, SC

#2 The first iPods were famous for the irreplaceable battery, and they are extremely hard to open. IFixit considers the iPod Classic battery replacement "very difficult," and you can find some YouTube videos on opening and replacing the battery if you dare to do it yourself.

If you wish to continue using your son's iPod Classic as a portable music player but don't want to risk damaging it, consider attaching a portable external battery. If your iPod Classic uses a USB cable to charge, then buy an external USB battery which can supply five volts and at least 0.85 amps (850 milliamps). Some are as large as the iPod, so just tape it back-to-back, and use the shortest USB cable between them. They are rechargeable from any other USB port, and will be useable with smartphones if you desire to retire that iPod.

Raymond J. Ramirez
Bayamon, PR

Hell, there are no rules here — we're trying to accomplish something.

Thomas A. Edison

ADvertiser INDEX

■ LOOK FOR ■ SEARCH FOR ■ FIND

Find your favorite advertisers here!

CLASSIFIEDS

SURPLUS

LIGHTING

DC POWER SUPPLIES FOR HIGH VOLTAGE AND SOLAR ARRAY APPLICATIONS

B&K Precision has now introduced three new models of high power programmable DC power supplies: models PVS10005, PVS60085, and PVS60085MR. The new PVS series delivers output power up to 5.1 kW with excellent regulation, low noise, and fast transient response times. All models provide a unique built-in solar array simulator (SAS) function to generate photovoltaic I-V curves. Offering high power density in a compact 2U form factor, these DC power supplies are especially suitable for high voltage testing up to 1,000V, motor inverter testing, and solar array testing applications.

Users looking to replace multiple supplies on a bench or rack can benefit from model PVS60085MR which offers multi-ranging operation up to 3 kW. This model shares the same voltage and current ranges of the PVS60085 (600V, 8.5A), and automatically recalculates voltage and current limits. Furthermore, users can select model PVS10005 for high voltage testing up to 1,000V at 5A. Unlike other high power supplies that require a three-phase AC line input, these power supplies only need a single-phase mains connection.

For programming, the power supplies provide a list mode function, an external analog programming and monitoring interface, and standard USB, RS-232, GPIB, and LAN interfaces supporting SCPI commands. Remote control software is also available for front panel emulation, generation, and execution of test sequences, and logging measurements via a PC. The PVS10005 and PVS60085 list at a price of $4,790; the PVS60085MR lists at $3,980; and the SASPVS software lists at $295.

For more information, contact:
B&K Precision
Web: **www.bkprecision.com**

KITS/PLANS

ROBOTICS

CONTROLLERS

AUDIO/VIDEO PARTS

MISC FOR SALE

SERVICES

ELECT DATA SYSTEMS

HARDWARE WANTED

RAMSEY
Spooktacular Halloween Treats!

Blinky-Eyes Animated Display

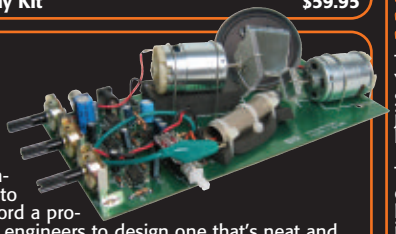
- ✔ **Animated display of 66 super bright LED's!**
- ✔ **Microcontroller controlled!**
- ✔ **Changes brightness automatically!**
- ✔ **Animated with constant motion!**

The ultimate animated LED kit that will dazzle you and delight your friends! Uses a microcontroller to randomly select from many different animations such as a long pause before a wink, or a twinkle of the eye to startle passers-by!

Four modes to satisfy any enthusiast's desires: 1. Off for long random periods, then blinks or winks. Designed to scare! 2. On for long periods before performing an animation, perfect for costumes and displays! 3. Animates all the time for constant motion, perfect display attention-getter. 4. Random fire! When placed in a pumpkin will light it up like you wouldn't believe! As if this weren't enough, the BE66 can also control a small hobby motor to shake bushes at random intervals or signal an external player to make a scary sound! Also has a CDS cell to sense light. In one mode, the display will dim as it gets dark for battery operation, and in the other mode it will turn off when it's too bright, so it plays only in the dark!

BE66 **Blinky-Eyes Animated Display Kit** **$59.95**

Laser Light Show



- ✔ **Audio input modulates pattern!**
- ✔ **Adjustable pattern & size!**
- ✔ **Projects neat motorized patterns!**
- ✔ **Uses safe plastic mirrors!**

You've probably seen a laser show at concerts or on TV. They're pretty impressive to say the least! Knowing that you can't afford a professional laser display we challenged our engineers to design one that's neat and easy to build, yet inexpensive.

Well, the result is the LLS1 Laser Light Show! This thing is sweet and perfect for your haunted house or halloween parties! It utilizes two small motors and a small standard laser pointer as the basics. Then, we gave it variable pattern and speed controls to customize the pattern!

Not enough, you say? How about a line level audio input to modulate the pattern with your CD's, music, or spooky sound effects? You bet! Everything is included, even the small laser pointer. Runs on 6-12 VDC or our standard AC adapter.

LLS1 **Laser Light Show Kit** **$49.95**
AC121 **12VDC 1A Regulated Power Supply** **$9.95**

Tri-Field Meter & "Ghost Detector"

- ✔ **See electric, magnetic, and RF fields!**
- ✔ **Watch the magnetic fields of the earth!**
- ✔ **Sense different magnetic poles**
- ✔ **Detect RF transmitter fields**
- ✔ **Graphical LED display allows you to "see"the invisible fields**
- ✔ **Great learning tool for EMF, RF, and manetic field theory**

Call it a Tri-Field Meter, an Electrical, Magnetic, and RF Detector, a Ghost Detector, or a Tricorder, but walking around with this on Halloween will seriously impress even the most doubting of Thomases out there!

The TFM3C has three separate field sensors that are user selectable to provide a really cool readout on two highly graphical LED bargraphs! Utilizing the latest technology, including Hall Effect sensors, you can walk around your house and actually "SEE" these fields around you! You will be amazed at what you see. How sensitive is it? Well, you can see the magnetic field of the earth... THAT'S sensitive!

The technical applications are endless. Use it to detect radiation from monitors and TV's, electrical discharges from appliances, RF emissions from unknown or hidden transmitters and RF sources, and a whole lot more! If you're wondering whether your wireless project or even your cell phone is working, you can easily check for RF! A 3-position switch in the center allows you to select electric, magnetic, or RF fields. A front panel "zero adjust" allows you to set the sensors and displays to a known clean "starting point." If the TFM3C looks familiar, it's probably because you saw it in use on the CBS show Ghost Whisperer! It was used throughout one episode (#78, 02-27-2009) to detect the presence of ghosts!

The concept is simple, it is believed (by the believers!) that ghosts give off an electric field that can be detected with the appropriate equipment. In the electric mode, the TFM3C's displays will wander away from zero even though there isn't a clear reason for it (not scientifically explainable, aka paranormal!). This would mean something has begun to give off an electric field. What it was in the Ghost Whisperer was a friendly ghost. What it will be in your house... who knows! Makes a GREAT leaning project besides! Requires 4 AA batteries.

TFM3C **Tri-Field Meter Kit With Case** **$74.95**

Automatic Animated Ghost

- ✔ **Automatically greets your visitors!**
- ✔ **Responds to sudden noises!**
- ✔ **Built-in microphone!**
- ✔ **Adjustable sensitivity**

Who says ghosts are make believe? Once your friends come upon this one they'll think differently! The unique circuit board design includes two ominous blinking eyes that change with various conditions, including sudden changes in ambient noise. A highly sensitive built-in microphone picks up anything from noises to talking and makes the ghost dance with its built-in motor, make eerie sounds with the built-in speaker, and randomly blink. A white cloth and a hanger are included as shown to make it look like the real thing. Runs on 2 AAA batteries (Not included).

MK166 **Automatic Animated Ghost Kit** **$21.95**

Halloween Pumpkin

- ✔ **25 bright LED's!**
- ✔ **Random flash simulates flickering candle!**
- ✔ **Super bright LED illuminates entire pumpkin!**
- ✔ **Simple & safe 9V battery operation**

The perfect "starter" kit with a terrific Halloween theme! You won't be scraping the seeds and guts out of this pumpkin! Six transistor circuit provides a neat random flash pattern that looks just like a flickering candle. Then a super bright LED illuminates the entire pumpkin with a spooky glow!

The pumpkin face is the actual PC board, and assembly is easy through-hole soldering of all components and LED's. Your pumpkin is powered by a standard 9V battery (not included) which snaps to the back of the pumpkin. An on/off switch is also included. Create a new kind of pumpkin this year, and learn about LED's and electronics at the same time!

MK145 **Electronic Halloween Pumpkin Kit** **$11.95**

High Power LED Strobe Light

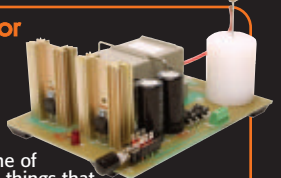
- ✔ **Everlasting LEDs won't burn out!**
- ✔ **Variable flash rate and audio trigger!**
- ✔ **Bass and treble trigger modes**
- ✔ **Safe low voltage construction, no fragile high voltage Xenon tube to break!**

Everyone has seen Xenon stroboscopes "stop" a spinning quarter or flash to music. Now you can get the same effect without the expense and hassle of high voltage Xenon tubes! Great for Halloween displays and parties!

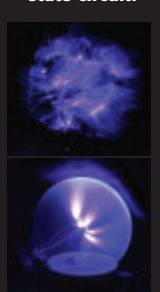
A plug-in 3x3 array of super bright Telux™ LEDs creates a brilliant, sharp flash similar to a Xenon flash tube. The LEDs can also be mounted directly on the main PC board or on a remote display board. Optional display boards also available. Variable flash rate from 1-220 FPS plus an audio flash trigger with selectable bass or treble triggering. Easy to connect with standard stereo RCA audio connectors. External trigger can be looped to additional units for simultaneous flash displays from the same source! Runs on safe 12-15VDC so a great kit for the kids to build!

LEDS1C **High Power LED Strobe Light Kit with Case** **$49.95**
LEDS8 **Display Board, Inline Array of 8 LEDs** **$17.95**
LEDS20 **Display Board, 5x4 Array of 20 LEDs** **$29.95**
AC121 **12VDC 1A Regulated Power Supply** **$9.95**

Spark Generating HV Plasma Generator



- ✔ **Generate 2" sparks to a handheld screwdriver!**
- ✔ **Light fluorescent tubes without wires!**
- ✔ **Build your own Plasma Balls!**
- ✔ **Generates up to 25kV @ 20 kHz from a solid state circuit!**

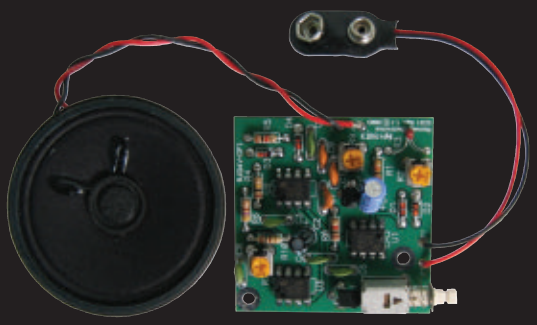


This popular kit was conceived by one of our engineers who likes to play with things that can generate large, loud sparks, and other frightening devices! And at Halloween there's no better effect than high voltage sparks flying through the air! The PG13 Plasma Generator creates a very impressive 25,000 volts at 20 kHz, to provide a stunning display of high voltage! It will draw a cool looking 2" spark to a hand held screwdriver, or light fluorescent tubes without any connection!

It produces stunning lighting displays, drawing big sparks, to perform lots of high voltage experiments. In the picture, we took a regular clear "Decora" style light bulb and connected it to the PG13 - WOW! A storm of sparks, light tracers and plasma filled the bulb. Holding your hand on the bulb doesn't hurt a bit and you can control the discharge! It can also be used for powering other experiments; let your imagination be your guide! Operates on 16VAC/VDC for maximum output. Can also be run from 5-16VAC/VDC to reduce the output voltage.

PG13 **Plasma Generator Kit** **$64.95**
PS21 **110VAC Input, 16VAC Output, Power Supply** **$22.95**

Electronic Chirping Cricket &

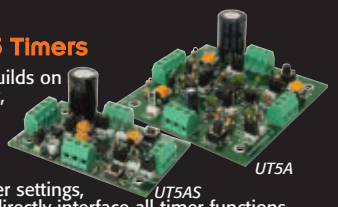


This Electronic Cricket is a lot more than a sound effect board! Sounds just like those little black critters that seem to come from nowhere and annoy you with their chirp-chirp! But just like the little critters, we also made it sensitive to temperature so when it gets warmer, it chirps faster!

That's right, you can even figure out the temperature by the number of chirps it generates! Just count the number of chirps over a 15 second interval, add 40, and you have the temperature in degrees Fahrenheit! Not as fancy as a digital thermometer but much more unique! And unlike its little black predecessor, the ECS1 operates from around 50°F to 90°F! A unique thermistor circuit drives a few 555 ICs providing a variable chirp that is guaranteed to annoy

ECS1 **Electronic Chirping Cricket & Sensor Kit** **$24.95**

Ultimate 555 Timers



This new series builds on the classic UT5 kit, but takes it to a whole new level! You can configure it on the fly with easy-to-use jumper settings, drive relays, and directly interface all timer functions with onboard controls or external signals.

All connections are easily made though terminal blocks. Plus, we've replaced the ceramic capacitor of other timer kits with a Mylar capacitor which keeps your timings stable over a much wider range of voltages! Available in through hole or surface mount versions! Visit www.ramseykits.com for version details.

UT5A **Through Hole 555 Timer/Osc Kit** **$21.95**
UT5AS **SMT 555 Timer/Osc Kit** **$29.95**

Digital Voice Changer

Sound just like the DJ's on the radio, but for 15 bucks! Alters your natural voice by changing the pitch, adding effects. Includes a built-in mic, 1.5W speaker out & line level audio out for your aux inputs. Runs on 9VDC battery.

MK171 **Digital Voice Changer Kit** **$14.95**

Pink Noise Generator

Generates pseudo random digital noise from 30-100 kHz. Great for optimizing your acoustics. Unlike white noise, pink noise provides equal power per octave or per 1/3 octave for a more natural sound. Can be modified for white noise. 12-15VDC.

K4301 **Pink Noise Generator Kit** **$19.95**

Xenon Tube Strobe Light

Create amazing effects with an authentic Xenon tube strobe light! Creates a super bright white FLASH with a variable speed of 2 to 20 flashes per second. Just connect 110VAC and you have a complete strobe light!

K5300 **Xenon Tube Strobe Light Kit** **$19.95**

Electronic Police Siren

Exactly duplicates the upward and downward wail of a police siren. Switch closure produces upward wail, releasing it makes it return downward. Produces a loud 5W output, and will drive any speaker! Horn speakers sound the best! Runs on 6-12VDC.

SM3 **Electronic Siren Kit** **$7.95**

LED Red Blinky

Alternately flashes two jumbo red LEDs. You've seen this used on name badges, hats, buttons, and attention getters for decades! Has been the most popular 1st learning kit for kids young and old! Runs on 3-9VDC.

BL1 **LED Red Blinky Kit** **$7.95**

Dusk To Dawn Blinky

The automatic "dusk to dawn" version of the traditional blinky kit! This little kit adds an adjustable light sensor to turn it on when it gets dark, and back off in the morning. Great for automatic signs, fake alarm indicators, and more. Runs on 9VDC battery.

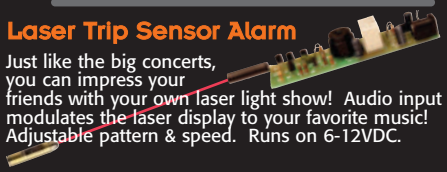
MK148 **Dusk To Dawn Blinky Kit** **$8.95**

High Intensity SMT Blinky

The SMT version of our famous BL1! If you want to learn SMT theory and soldering, this is perfect, we even give you spare parts to lose! 2 high intensity SMT LEDs alternately flash, and its small size makes it perfect for displays. Includes 2 standard LR55 button cells.

BL2 **High Intensity SMT Blinky Kit** **$17.95**

Laser Trip Sensor Alarm



Just like the big concerts, you can impress your friends with your own laser light show! Audio input modulates the laser display to your favorite music! Adjustable pattern & speed. Runs on 6-12VDC.

LTS1 **Laser Trip Sensor Alarm Kit** **$29.95**

LED Animated Smiley

This cute little LED smiley displays 9 different animated expressions to suit any mood! You can choose between fixed or animated for a dynamic display. Features auto-power-off to save batteries. Runs on 3 standard AAA batteries. 3" x 3" x 1.28".

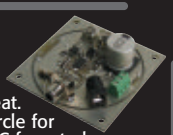
MK175 **LED Animated Smiley Kit** **$19.95**

Mad Blaster Warble Alarm

If you need to simply get attention, the "Mad Blaster" is the answer, producing a LOUD ear shattering raucous racket! Super for car and home alarms as well. Drives any speaker. Runs on 9-12VDC.

MB1 **Mad Blaster Warble Alarm Kit** **$9.95**

20 Watt Mini Audio Amp



Delivers a super clean 20W output from one SMT package! Ultra efficient class D design produces no heat. PCB can be snapped into a small circle for special applications. Runs on 18VDC for rated output, or down to 10VDC for reduced output.

UAM2 **20W Subminiature Amp Kit** **$52.95**

Audio Recorder/Player

Record and playback up to 8 minutes of messages from this little board! Built-in condenser mic plus line input, line & speaker outputs. Adjustable sample rate for recording quality. 4-switch operation that can be remote controlled! Runs on 9-12VDC at 500mA.

K8094 **Audio Recorder/Player Kit** **$32.95**

Electronic Watch Dog

A barking dog on a PC board! And you don't have to feed it! Generates 2 different selectable barking dog sounds. Plus a built-in mic senses noise and can be set to bark when it hears it! Adjustable sensitivity! Unlike my Greyhound, eats 9-12VDC, and isn't fussy!

K2655 **Electronic Watch Dog Kit** **$39.95**

Tickle-Stick Shocker

The kit has a pulsing 80 volt tickle output and a mischievous blinking LED. And who can resist a blinking light and an unlabeled switch! Great fun for your desk, "Hey, I told you not to touch!" Runs on 3-6 VDC.

TS4 **Tickle Stick Shocker Kit** **$9.95**

Electronic Dripping Faucet

Like a drip in a bucket, somewhere between a car chime and leaky faucet, no better way to describe it! Makes a repeated pleasant plink sound, great for alarms, or just plain sound effects! Runs on 4-9VDC or a standard 9V battery.

EDF1 **Electronic Dripping Faucet Kit** **$14.95**

Steam Engine & Whistle

Add the sound of a vintage locomotive steam engine and whistle to your next project! Features variable engine speed and volume, and a whistle blast at the push of a button! Includes small speaker. Runs on 9VDC battery.

MK134 **Steam Engine & Whistle Kit** **$11.95**

Stereo Ear Super Amplifier

One of the neatest ultra high gain audio amp around! Boosts audio 50 times and in stereo! Includes 2 45° electret condenser mics for perfect separation. Adjustable volume, 3.5mm audio output.

MK136 **Super Ear Stereo Amplifier Kit** **$9.95**

Electronic Metronome

Looking for a simple metronome to keep a standard tempo? Don't want the mechanical cluge, or the electronic bells & whistles? This is it! Includes volume, variable BPM, board mounted speaker, and silent LED BPM mode. "Can't be beat"! Runs on 9V battery.

MK106 **Electronic Metronome Kit** **$10.95**

Electret Condenser Mic

This extremely sensitive 3/8" mic has a built-in FET preamplifier! It's a great replacement mic, or a perfect answer to add a mic to your project. Powered by 3-15VDC, and we even include coupling cap and a current limiting resistor! Extremely popular!

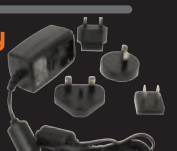
MC1 **Mini Electret Condenser Mic Kit** **$3.95**

12VDC Regulated Supply

Go green with our new 12VDC 1A regulated supply. Worldwide input 100-240VAC with a Level-V efficiency! It gets even better, includes DUAL ferrite cores

AC121 **12VDC 1A Regulated Supply** **$9.95**

12VDC Worldwide Supply



It gets even better than our AC121 to the left! Now, take the regulated Level-V green supply, bump the current up to 1.25A, and include multiple blades for

PS29 **12VDC 1.25A Worldwide Supply** **$19.95**

GET THE NUTS AND VOLTS DISCOUNT!

*Mention or enter the coupon code **NVRMZ142** and receive 10% off your order!*

800-446-2295
www.ramseykits.com

RAMSEY ELECTRONICS®
590 Fishers Station Drive
Victor, NY 14564
(800) 446-2295
(585) 924-4560

STELLAR PERFORMANCE

HITEC

TAKE CONTROL OF YOUR BOT WITH OUR STATE-OF-THE-ART AURORA 9X TRANSMITTER. ENGINEERED WITH DUAL PROCESSORS FOR LIGHTNING FAST RESPONSE, ULTRA-SMOOTH 4096 RESOLUTION, REDUCED LATENCY AND 7MS FRAME RATE, THIS TRIPLE PROTOCOL COMPUTER RADIO DELIVERS OUT OF THIS WORLD PERFORMANCE. COMBINED WITH OUR EXTENSIVE SERVO LINE OFFERING ADVANCED TECHNOLOGIES AND THE BEST IN ULTRA PRECISION, HIGH RESOLUTION AND ENERGY EFFICIENCY, A HITEC SYSTEM CATAPULTS ANY PROJECT TO METEORIC HEIGHTS.

REACH BEYOND WITH HITEC

HITEC RCD USA INC | 12115 PAINE STREET | POWAY, CA 92064 | (858) 748-6948 | WWW.HITECRCD.COM